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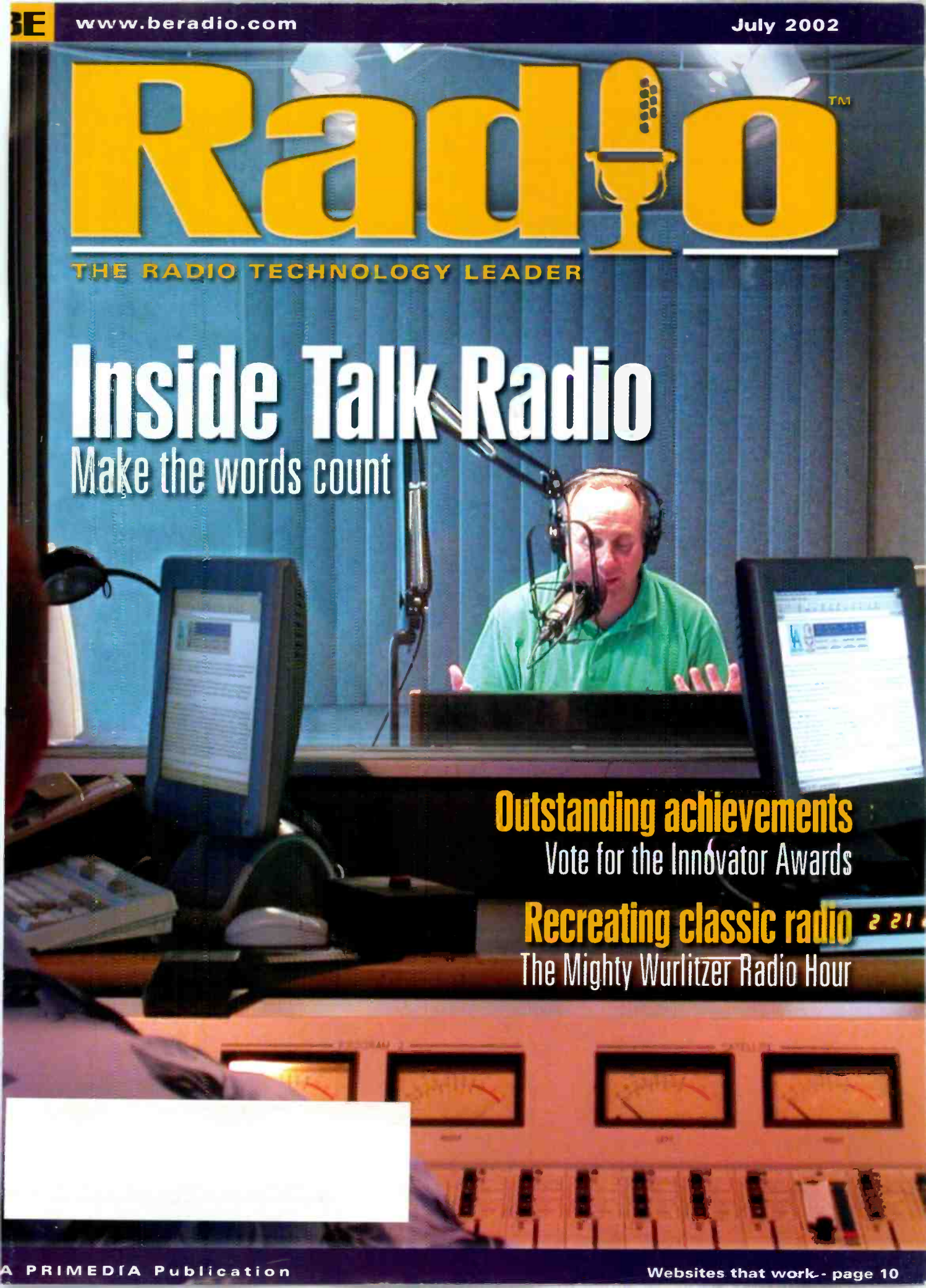
Radio™

THE RADIO TECHNOLOGY LEADER

Inside Talk Radio

Make the words count



Outstanding achievements

Vote for the Innovator Awards

Recreating classic radio

The Mighty Wurlitzer Radio Hour

A PRIMEDIA Publication

Websites that work - page 10

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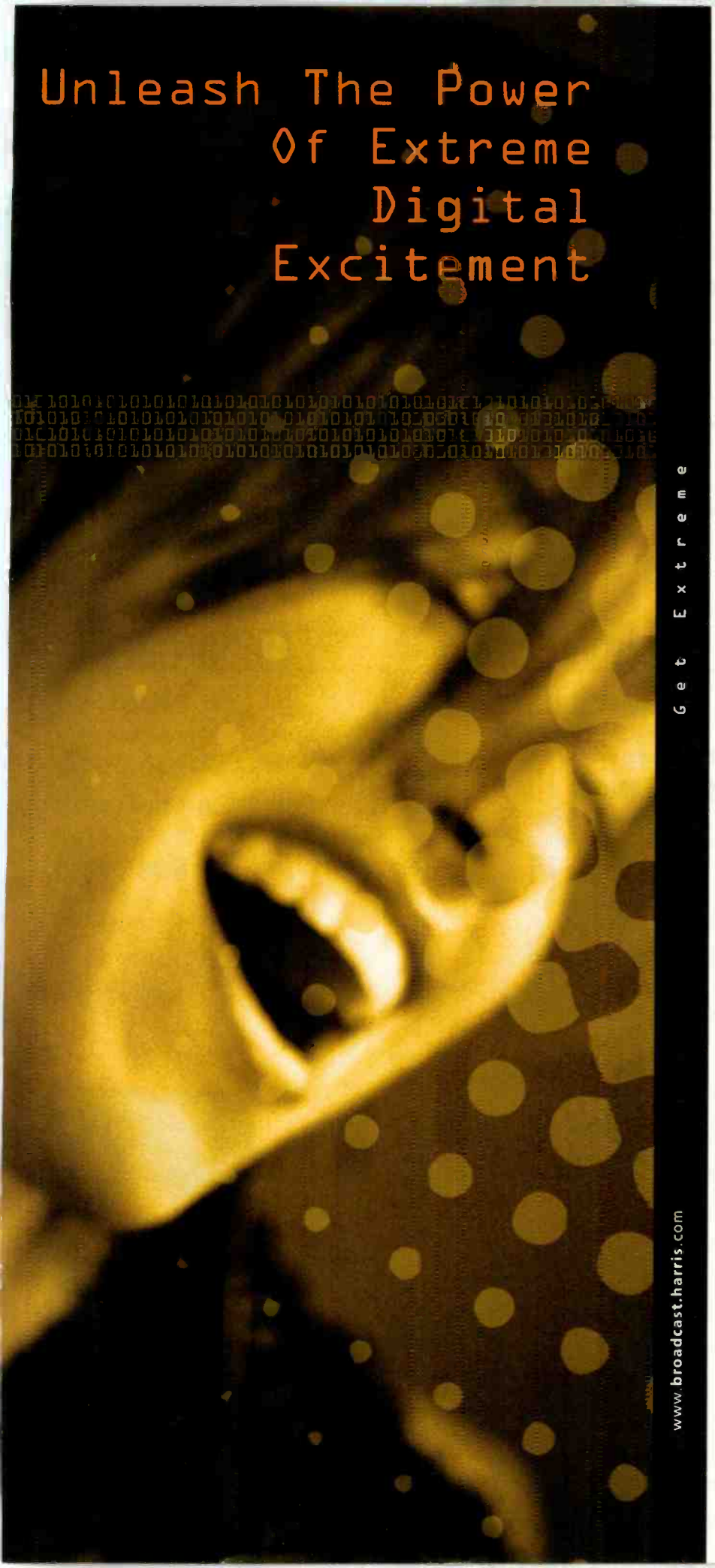

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THE RADIO TECHNOLOGY LEADER
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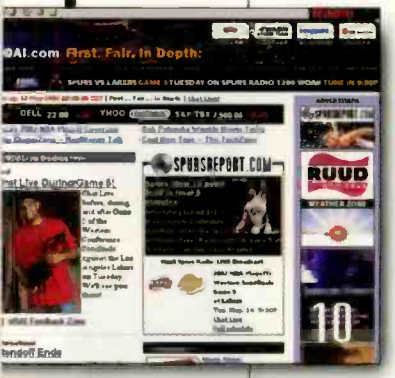

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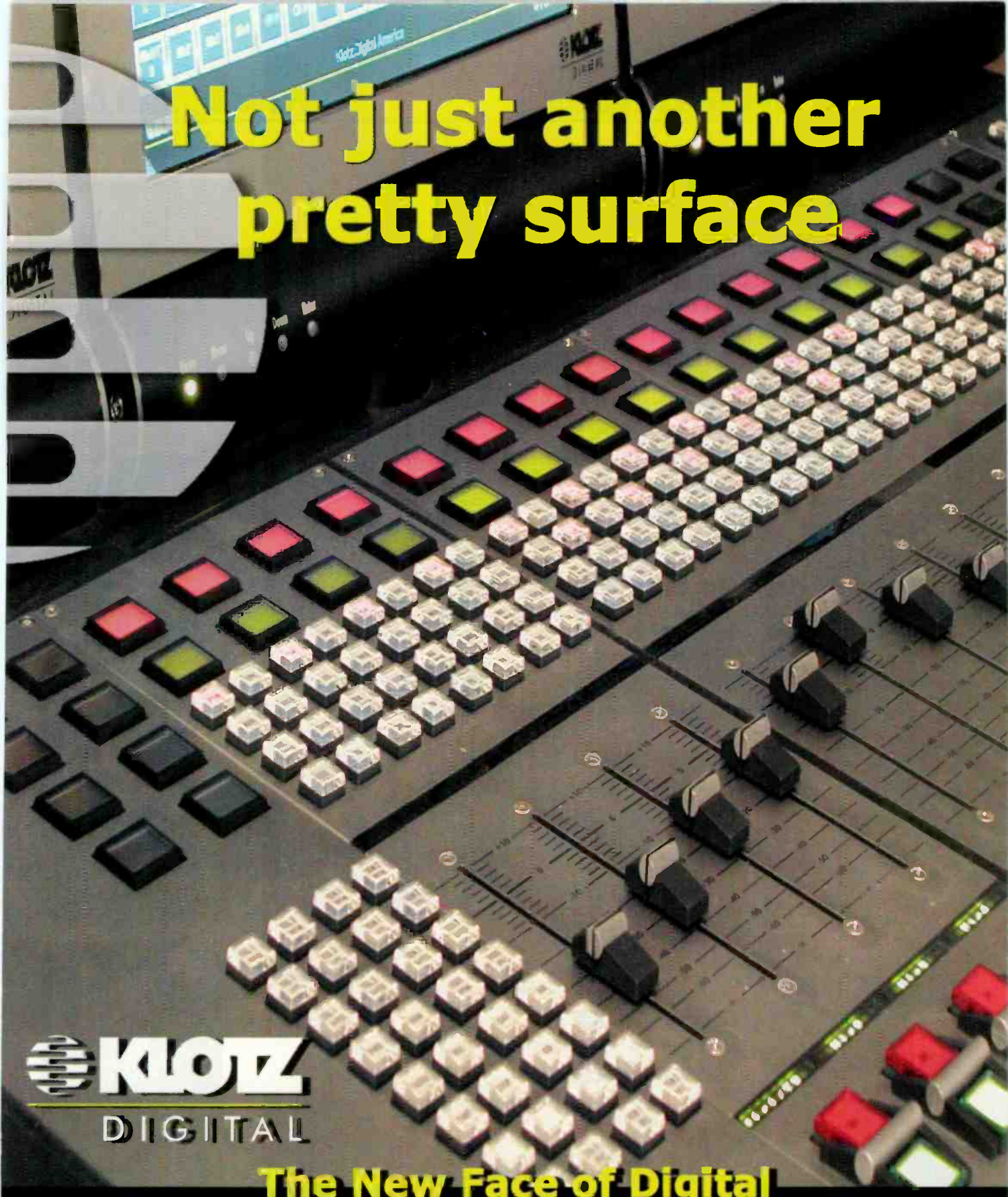
ON THE COVER:
Every word counts in a talk radio format. With such an attentive audience, attention to the sonic details is important. Photo of Mike Reagan, nationally syndicated talk show host on Premiere Radio Networks, by Barry Victor. Cover design by Michael J. Knust.



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Currents Online

Highlights of news items from beradio.com from the past month

Baffling Cincinnati RFI Case Solved

Radio amateurs work with power company and WLW to identify troubling RFI case.

RDA Systems Named Auditronics Dealer

RDA, which is already a factory-qualified installer of the entire Wheatstone product line, adds the console line to its card.

Sirius Upgrades to PAC v4

The new version of the audio codec, developed by Ibiquity Digital, is derived from the latest generation of psychoacoustic modeling.

NWS Gets New Voices

The voices are more understandable and human-sounding than the previous voice.

FCC Forms Spectrum Policy Task Force

Task Force will assist the Commission in identifying and evaluating changes in spectrum policy that will increase the public benefits derived from the use of radio spectrum.

Patriot Acquires Antenna Tooling from Eagle

The purchase includes 3.7 and 4.5 meter antennas and commercial-quality 0.75 meter antenna.

ERI Names Jones to Engineering Manager

Kinsley Jones will plan and direct all engineering activities of the antenna division.

Site Features

Vote for the Innovators

Cast your vote for the 2002 Innovator Award from BE Radio. Look for the ballot link on the home page.

Reader Feedback

See what is on the minds of BE Radio readers.

Engineer's Notebook

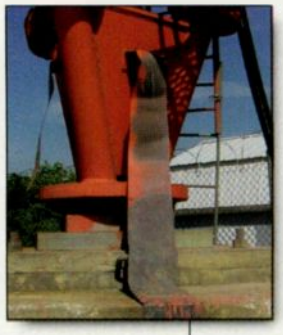
Tips, tricks and hints that you can use. Send us yours and we'll add it to the list.

Studio Spotlight

Take a virtual tour of other stations.

EAS Manufacturers' Upgrade Information

Following the FCC Rule change, you can stay on top of the information from the manufacturer of your EAS equipment.



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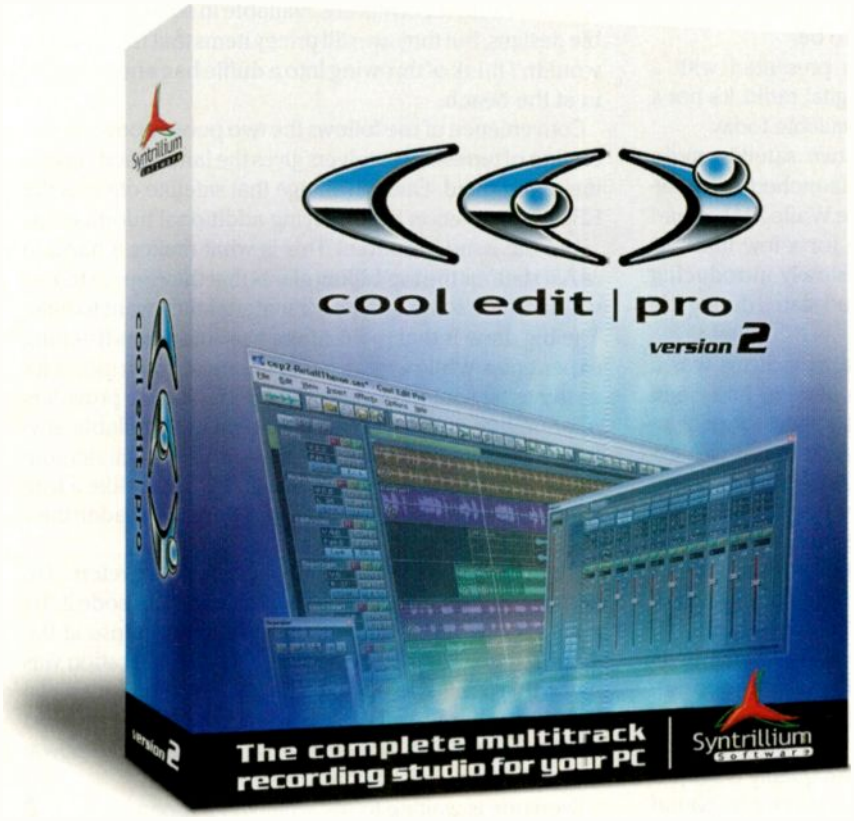

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Digital radio has arrived

The next phase of radio's evolution has begun. Last month, I talked about the delays in the transition to DAB for terrestrial radio, a process that is going into its 10th year of development. Less than five years ago, the FCC awarded two licenses for S-DARS service so that another form of DAB could be created. I had hoped that the terrestrial form would beat the satellite form to a service date, but this was not to be.

Listeners have been presented with a choice for portable digital radio. It's not a free choice, but it is available today.

XM and Sirius, the two satellite radio providers, have launched their services nation wide. While XM has had national service for a few months, Sirius has been slowly introducing service to selected states during the past few weeks.

The official start for Sirius was a quiet event. The service had been rolled out in small doses, and in the final weeks before the national kick-off, Los Angeles, New York City and New Jersey were the last pieces to be added to the mix.

So while the IBOC work continues, listeners are debating the merits of the two available radio choices: terrestrial or satellite. The issues of sound cost, quality, content, flexibility of service and convenience of use are part of the debate. What is a listener to do?

The debate over sound quality is subjective. Analog terrestrial radio can sound good, and FM service with few interference problems is accepted as a quality sound source. Many digital encoding schemes are even described as FM-like or FM quality. Analog AM has its problems, but in most cases delivers an acceptable quality. Both can be good but frequently are less than ideal. Satellite radio, on the other hand, delivers a clean signal at all times. While the encoding scheme is sometimes audible on the audio, it is interference-free.

What about cost? This is an easy one. Terrestrial radio is basically free. Satellite radio will cost you $10 to $13 per month plus the cost of new hardware, which starts at $300. A terrestrial-radio receiver can be picked up for a few dollars.

The issue of flexibility of service also favors terrestrial. Walkmans, boom boxes, clock radios and factory-installed car radios are everywhere. Most local terrestrial stations can be picked up without an external antenna. Satellite-radio receivers are available in somewhat portable designs, but they are still pricey items that most people wouldn't think of throwing into a duffle bag and plugging in at the beach.

Convenience of use follows the two points above. Proliferation of terrestrial receivers gives the land-based service the upper hand. One advantage that satellite offers is the RBDS-like function of displaying additional information.

The big issue is content. This is what makes a handful of AM stations the top-billing giants that they are. Listeners will sacrifice some quality for material they want to hear. The big draw is that radio offers a spontaneous listening experience. While we can easily create our own mixes, it's easier to let someone else drive. Both satellite providers offer unique content choices that are not available anywhere else. It is my hope that Sirius and XM will demonstrate to terrestrial radio stations that listeners like a true variety, and therefore entice local stations to broaden their playlists and look beyond the safe choices.

Throughout the years, satellite radio has been referred to as the Death Star. Last month I saw Star Wars Episode 2. By coincidence, the movie contains the first glimpse at the plans for the Death Star. When the official notification was made that Sirius was up and running, I was reminded of a line from Star Wars Episode 6 describing the celestial weapon (modified slightly): "Now witness the firepower of this fully operational battle station."

Everyone is waiting to see what will happen.

Chriss Scherer, editor
cscherer@primediabusiness.com

What are your thoughts on satellite radio? Can two services survive? Will satellite radio kill terrestrial radio?

Send comments to: **E-mail:** *beradio@primediabusiness.com*
Fax: *913-967-1905*

Last-minute remotes?

No stress for John Kennedy of Entercom Boston.

The Patriots win the Superbowl! A major cause for celebration in Boston. And potentially major stress for John Kennedy, Engineering Director for Entercom Boston. With no advance warning, John had less than 24 hours to orchestrate coverage of the festivities on numerous stations — including live remotes along the Patriots' parade route. Fortunately, John knew he could count on Comrex Matrix to deliver — even last-minute. With Comrex in your toolbox, last-minute remotes are successful, not stressful.

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John Kennedy,
Engineering Director,
Entercom Boston

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Websites that work

Stephanie P. Snyder

Why do users spend more time on some websites than others? What makes users come back to favorite sites time and time again and pass over others? Is it flashy graphics and animation? Bright colors? Current news? While any of those things can be part of a good website, there are more elusive traits that can transform a good website into a great website.

When designing for the Web, the number one rule is: Keep the user in mind. Every radio station has a target audience, and when planning the site, think of that person. In addition to demographic data about age and sex, a designer should know the type of technology that the target market is using. How does the user connect to the Internet? What browser is he more likely to use? Is there a brand of computer and monitor size that he prefers?

Daily updates keep WOAI San Antonio's Web content fresh, bringing visitors back.

Designs that work for a CHR audience might not be appropriate for a news/talk station. More importantly, what a Web design firm or consultant finds most exciting to build, may or may not fit the radio station listener's needs. Great websites put the needs of the users first.

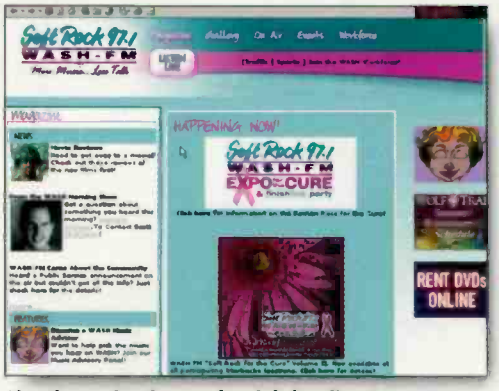
Page layout

Too many websites are victims of poor design, and radio station Web pages are no exception. Placement of images, use of space, choice of type font and colors will determine how well the audience receives the message. If the initial site layout is ineffective, the user will surf away within a few seconds and the message will never be delivered. Make first impressions count. Present the main features of your site in the first one or two screens. Many users dislike scrolling down to view pages, so place important elements above the fold, meaning in a location that is visible when the page first loads.

All websites should be easy to read. Text should be large and clear. Color should be chosen carefully and used to enhance the design of the site. Avoid using background colors in the same shade as the text. Special effects should be used only when they add value to the site and fit your target market. Many Web designers get caught up in the latest fancy additions, even though too many effects at once can overwhelm the user. Complex backgrounds, scrolling text, hidden images, sounds, animations and other features can be effective in Web design, but use them sparingly and only when there is a reason to do so.

Navigation and content

Clarity and consistency are key to a successful website, and nowhere is this more apparent than in navigation. The website visitor always wants to know, "where am I?" The next question will usually be, "where do I go next?" Great websites make it easy for the user to answer these two questions. Buttons or menus to guide the user through the site should be clearly marked and visible at all times. Often these are placed at the top or side of the page. Repeating the appearance, location and function of navigation elements on every page allows the user to learn the rules of the road. A consistent layout also builds a site identity in the mind of the user and he will come to associate the look and feel of the site with the radio station.



Simple navigation and quick-loading images make DC's WASH page a breeze for the user.

Users need some reason to visit one website vs. another website. A colorful logo is not enough to keep a user on a website or make him return later. What keeps him on a page after the first impression is the site content.

To make the website memorable, give the listener something valuable. This could be advice, information, entertainment or contests depending on the station format. What does the station website offer that the user cannot get anywhere else? Obvious columns for many stations are local weather, news and event or concert calendars. Content must be accurate, fresh, compelling and easy to find.

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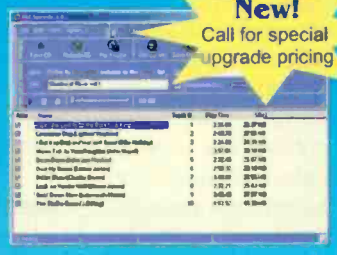

Speedy 4.0 $199
CD-to-PC recorder

Stinger
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$199

WaveCart
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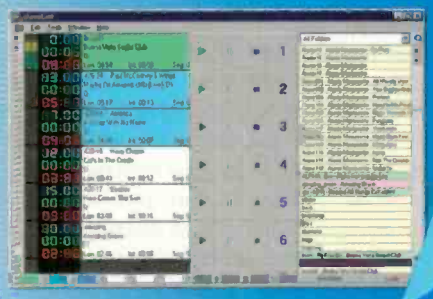

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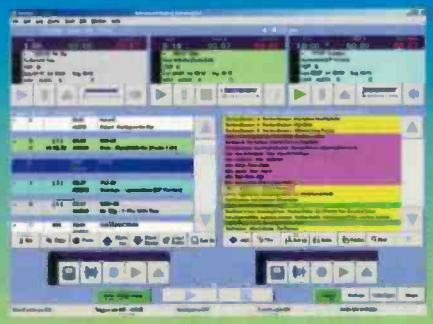

Simian $1499
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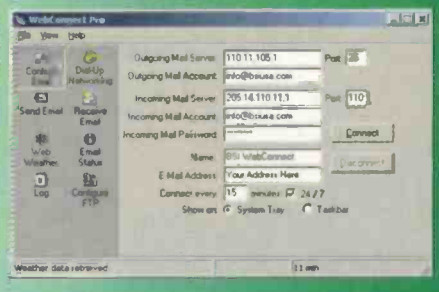

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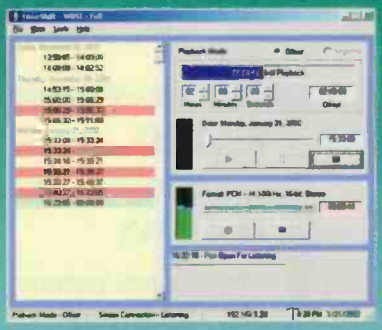

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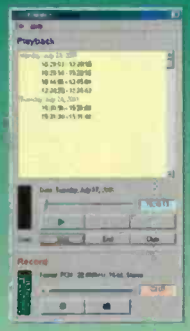
continuous record of audio and tones with time-delay or random-access playback.



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BSI

Information on the Web ages quickly, so update regularly to prevent your site from becoming stale.

Creating fresh, original content on a regular basis can be a chore. If station resources do not allow for a team of Web producers to create content, filter and gather interesting information for the listeners instead. If the local newspaper already offers comprehensive news on the Web, don't duplicate its work, link to it. If there is a popular fan site about music played on the station, link to that. By linking to content that is specific and relevant to station listeners, the website will be current and still offer a valuable service. Avoid becoming nothing but a list of links. Point directly to an article or a specific resource whenever possible, rather than to a home page. Sites that have some useful grouping or sorting stand out and will be revisited more often than a simple list. Regularly check links for accuracy.

Animation and slick graphics target the younger audience of Chicago's WBBM.

Another way to develop original content with minimal time investment is to start a community of users and let them create the content for you. User surveys, chat rooms and online forums allow visitors to share information with others and can help shape your site to better serve their needs. Let the audience talk about the local hot topics. An online forum makes you part of the users' lives, making your website of more interest to them.

The Web is an interactive medium and great websites encourage contact. Allow users to contact the station for more information or with comments and suggestions about your site. They will feel more involved with the station and the website manager will learn what is working and what can be improved. At a minimum, include a contact e-mail address for the webmaster. In addition, some stations provide e-mail addresses or feedback forms for one or more departments. Make it a point to respond promptly to all user inquiries.

Back for more

A great website is one that users come back to again and again. Websites aim to create repeat users because more users, more often, means the site can charge more for advertising. In the case of a radio station, more Web users also means more listeners are interacting with the station at times they may not have listened before. By keeping the user in mind when designing a site and by offering current and original content in a clear, consistent format stations can transfer a loyal over-the-air listener into a repeat website user.

Snyder is an independent streaming media consultant based in Australia.

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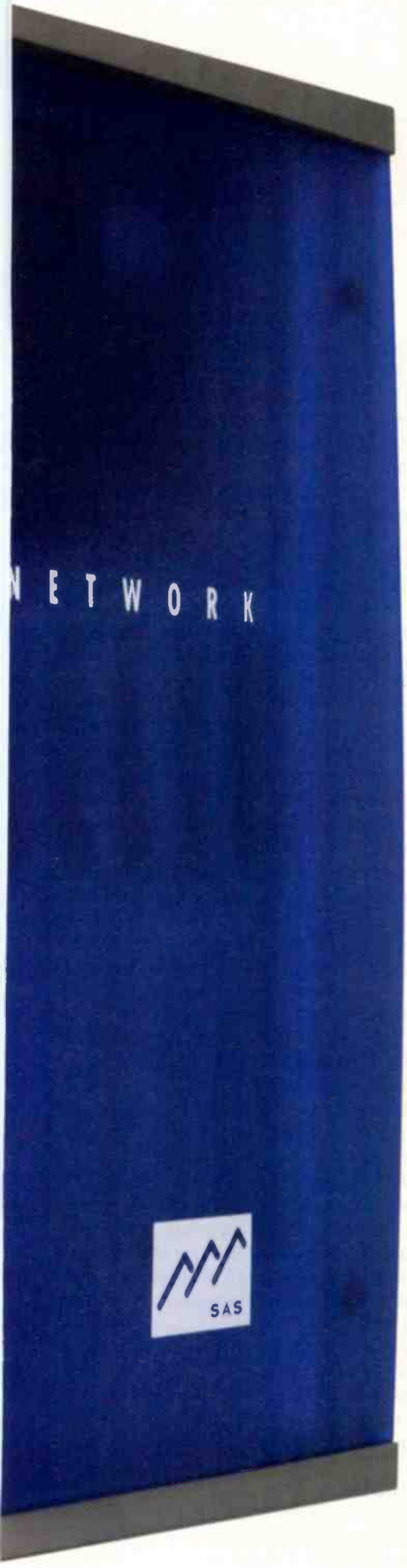

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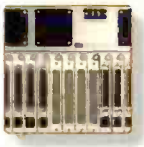

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Dynamic Web content

By William Harrison, Jr.

In these days of dwindling budgets and personnel, improving your Web presence can seem costly, but it may turn out to be a sound investment in the long run. With a larger Web presence you may reach a larger audience, or sell more online advertising. Adding dynamic content is one way to give the impression that you have a larger presence that you really do, and it can be done for next to nothing.

It's not rocket science to add dynamic aspects to websites. It just takes a little patience and know-how, and the ability to search on Google to find help from those who have gone before you.

Regardless of the type of server you run (Linux, Windows, Solaris), the principles are all similar. The same can be said for programming languages: the correct programming language is the one your server supports, and the one your programmer is comfortable using. Personally, I believe in open source software, so my examples may be slightly biased towards those using Linux variants, but if you have the money to spend, there are commercial solutions available that are ready to fulfill your needs.

A site search capability and a date stamp are two easy ways to enhance a website.

Schedule, schedule

Probably the easiest way of using dynamic content is to create it ahead of time, and let the server post it at scheduled intervals. Perhaps you want to change your homepage every Sunday morning, but don't want to work during the weekend. No problem. On Friday, create the new version of the homepage (for example, let's call it *sunday.html*) and use a scheduler (*cron* in Linux and Unix variants; *AT* in Windows) to copy the new file over your old homepage file. Just be careful when you set this up; if you schedule it to run every Sunday and you forget to create the *sunday.html* file, you may end up with no homepage at all when you come in Monday morning.

The most useful example of dynamic Web content may be the 'What's on Now' or 'Now Playing' feature (which is strange, because there are few scripts available for download that do this). People come to your site to look at your programming schedule, but what if they're only interested in finding out what's playing now or what's coming up next? Using the method above, you could create a homepage for each hour of each day, all almost identical except for what's playing now and next, but that's a lot of files to have to worry about.

Instead, you could use Javascript to determine the day of week and the time of day, and then use a series of if/then statements to display the appropriate information. As a side note, try to avoid using Javascript for date and time functions because it returns the date and time of the user's computer, so a user in California viewing a website in Virginia will see an incorrect time. Use a server-side language like PHP or Visual Basic because it will return the server time. There's a second hidden benefit to using a server-side language as well: you will minimize the bandwidth (and consequently improve load time) because you won't be sending lots of data that the browser won't be displaying.

Step up to the mic

Perhaps the most dynamic content is the kind you don't create yourself. There are a lot of people out there, and most of them would like a place to share their ideas with others, so why not let them be shared on your site? Many good discussion board software packages are free (open source), take up little server space or bandwidth and keep people coming back to read and reply, especially if you use a discussion topic that people feel strongly about. Start a political board, a recipe exchange or even a feedback forum where users can post their comments on concerts given by local bands.

If you're not comfortable giving people access to post on whatever topics they desire, then limit their options by using a poll. You choose the question and the answers. All the users get to do is vote. Again, it's quick to set up, inexpensive and takes care of itself once it is running.

Save the date

Try adding a calendar to your site. Include programming schedules and cultural events covering your local listening area. Music stations can create relationships with some

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of the concert venues in the area, and allow them to enter information for their performances into your system. Promote local appearances by station jocks and other station activities in the community.

There is a lot of free content out there. The National Weather Service provides forecast information for all 50 states, based on ZIP codes, in either a human- or machine-readable fashion. Writing a simple script to request this information, parse it and display it can't be too difficult because there's an open source project doing it already (PHP Weather on SoundForce). Look at the examples and it should all be straightforward.

Additionally, there are news services that can provide your site with headlines on a regular basis, using Javascript to pull them from files on other servers. This is useful for getting others' content to appear on your site, but be aware that you may have to put up with a delay in page load time while the user waits not only for your server to respond to them, but also for the other server to respond to your server. NPR-affiliated stations can use some of the modules available for shows such as *All Things Considered*, which provide information about the day's guests and show topics, and display them on your site automatically. Check with your syndicated program provider to see if similar services are available.

Content management systems

Considered to be the holy grail of website management is the content management system (CMS). There are hundreds of options here, from freeware open source solutions such as Zope and Phoundry, to those that cost thousands of dollars, such as Interwoven, Vignette and Microsoft's Content Management Server. Most of these allow multiple people to have certain access to perform certain tasks, such as upload a new page on your site, schedule content to appear on the homepage or edit and approve a piece of content before it is posted. They can be sophisticated, storing everything in an Oracle database, or simple, storing each page in its own HTML file. They can be flexible or rigid, depending on the product and the people setting it up.

The key to having a good CMS is finding a person or company to set it up correctly from the start. Most of them are not viable out-of-the-box solutions, but rather toolkits to enable you to take various aspects you like and weave them together to perform particular functions. They need to be customized to your particular application to be as flexible as possible in the future.

Words to the wise

1. Start simple: Display the date on your pages. Yes, it's cheesy; yes, most people realize it's being done automatically, but it's quick and easy and can be done with almost no technical know-how.
2. Add a search box to each of your pages. It doesn't have to be big, but make sure your users can see it immediately. The quicker you can get the user what they want, the more time they have to spend looking around your site.
3. Whatever it is you want to do, odds are it has been done before. Before you go off to create your own version of it, do a few searches and take a look at how others have handled it. Keep what you like, throw out what you don't like and go from there.
4. Investigate sharing your work with other stations. If you want to add a particular feature to your site but can't afford to, maybe you can partner with another station interested in doing something similar.

Harrison is manager of Web technology for WETA-FM and WETA-TV, Arlington, VA.

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Grounding and signal problems

By John Battison, P.E., technical editor, RF

Adequate grounding means different things to different engineers. To the electrical engineer it means compliance with the National Electric Code (NEC). To the RF engineer it means proper grounding and lightning protection for all pieces of equipment connected with RF power transmission. To the audio engineer it means correct grounding to eliminate the possibility of hum or instability developing in the audio signal. Overall it also means compliance with those portions of the NEC that apply in particular circumstances, as well as individual state and local ordinances. In addition, the engineer is concerned with questions of audio quality and hum. Overriding all the considerations of audio quality and noise in the signal is the necessity for providing a safe system that is free from electrocution or burns from primary power ac, RF power or dangerous ac voltages developing in the audio equipment wiring and equipment.

Photos by Ben Weiss, CPBE

A secure and reliable ground system is a critical part of any RF installation.

I will not touch much on power engineering at this point because more and more it is becoming beyond the purview of radio engineers whose power installations usually have to be completed by state-approved and licensed contractors, and most radio engineers are not state licensed to perform such work. Sometimes this leads to problems when new installations are made that are subject to inspection by non-radio minded inspectors before completely installed, as well as afterwards. It seems that as the world becomes more and more regulated and licensed individual freedom of design and application becomes more circumscribed by political, or local union interference.

A typical argument with electrical inspectors frequently is ac power connections inside equipment cabinets. Sometimes there is a wide divergence in opinions and requirements for the location of electrical outlets inside a cabinet. This can often be a sticking point in an inspection in a large city—and sometimes even in small ones. Another argument is often the actual grounding location, and its interaction with other radio grounds.

It is best to bring the primary ac power in underground. Sometimes the power company owns the transformer and sometimes the broadcaster has to pay for it. In cases where the station is at the end of a short, dedicated line it may pay to own the transformer. This enables the broadcaster to have some control over which users are connected to his line. In any case a surge suppressor should be installed directly at the point of entrance into the transmitter building and connected directly to the system ground.

An adequate ground system is essential for any radio station. In the case of AM stations this is provided through the antenna ground system. However, sometimes this large and efficient ground system is some distance from the studio/transmitter building where the primary power ground is located. Of the station components located in the area of the antenna ground system, few are connected to the ac power line. There is usually one, however, and that one can sometimes cause problems and introduce hum in an AM signal. I am referring to the tower lighting system.

Seeing the light

The tower lighting system is tied to the antenna ground system, and it is powered by an underground cable from the transmitter building. From time to time we hear of signal interference produced by leaking or damaged components in the tower lighting system.

In the case of FM stations the antenna tower grounding is, unfortunately, sometimes less than adequate. Unlike AM transmitters, a large and efficient ground system is not required for FM stations, which rely on line-of-sight coverage. As a result many FM towers are grounded by a few grounding rods at the tower base. This is usually inadequate, and it is not unusual for lightning strikes to damage transmitters and associated equipment.

The damage caused by a lightning strike could be prevented by properly grounding the tower and transmission line. A few standard grounding rods connected by

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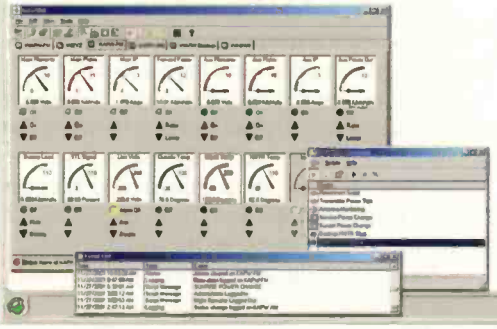

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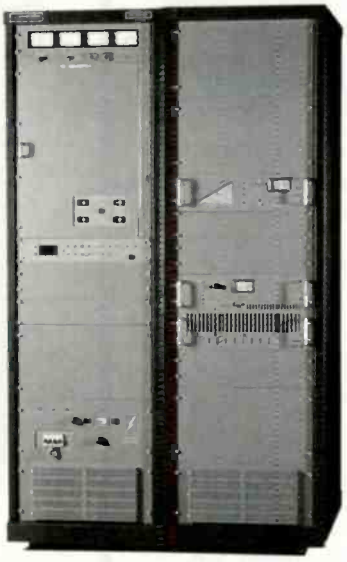

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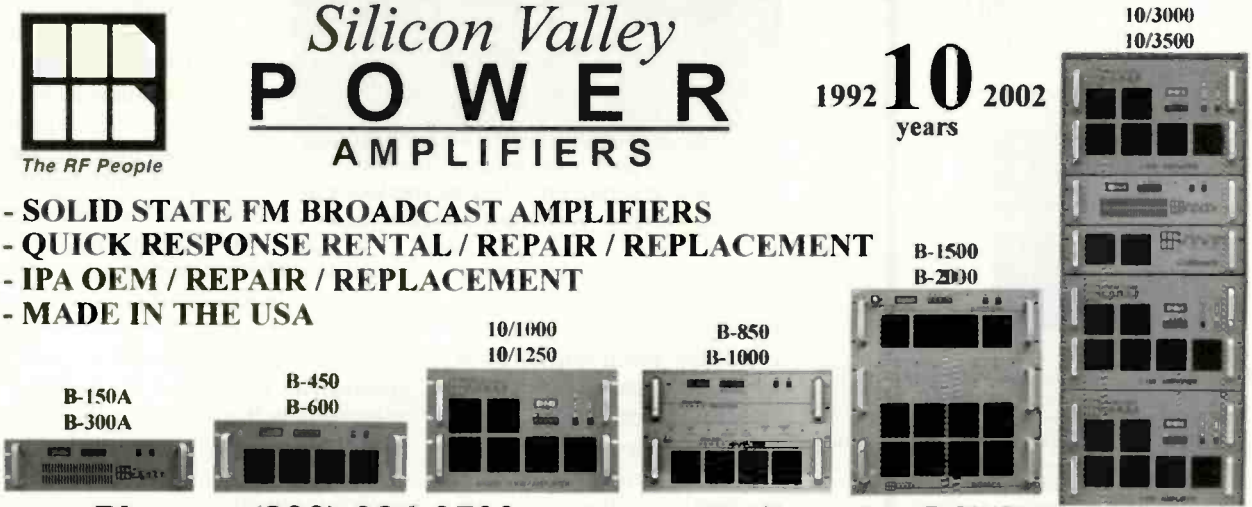

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pieces of small-gauge copper wire will not dissipate the high current produced by a lightning strike. Before vaporizing, the small gauge copper wire will present a high impedance to the lightning that will seek an easier path, which usually turns out to be transmitting equipment. In many of the smaller FM stations, far more consideration needs to be given to FM tower grounding.

RF grounding

It is in the transmitter building and ATUs that grounding becomes of the greatest radio engineering importance. It is not just for appearance that manufacturers of phasors and ATUs lay the expensive 4-inch copper strap on top of the cabinet floors and walls to interconnect inductances and capacitors. Not only does the copper strap ensure a perfect connection between components, but its presence tends to reduce stray RF voltages from developing in cabinet sections.

The presence of a 4-inch copper strap interconnecting tower bases to the transmitter output is also important. It is not unusual in small stations, especially non-directional installations, to find that the only connection between the transmitter ground and the ATU is the outer conductor of the coaxial transmission line. Theoretically, this outer conductor will suffice to carry the currents between the transmitter and the radiating system. However, the 4-inch copper strap is needed to stabilize the radiating system and ensures an adequate connection to and from the ground system.

A continuation of this 4-inch copper strap should extend to the base of all equipment cabinets. Sometimes in high AM RF fields, a 2-inch copper strap is brought inside each cabinet to provide even better grounding connections. It is common to find a copper screen forming a Faraday shield around the transmitter, and some audio facilities are required in high-power installations located close to the antenna.

Photos by Ben Weiss, CPBE

Examples of a poor tower ground (top) and a good tower ground. Not only is the conductor in the poor example too small, it is not attached.

Signal grounding

Sometimes problems arise when attempting to ground cable shields where an automatic ground is already in existence through a third grounding pin on an equipment cable. Only one end of a cable shield should be grounded. If both ends are grounded, a current will flow through the shield. If the potential difference between the two ground connections is high enough it is possible for hum to be produced.

In areas where high RF voltages are present, audio (and video) signals produce a wide variety of interference ranging from whistles to buzzes. RF interference to unshielded or ungrounded video equipment usually produces the familiar herringbone interference pattern. When investigating sources of RF interference to studio equipment it is important to confirm that the connection known as ground really is a good ground connection. This is especially true if a water pipe has been used as a ground. Hot water pipes do not make suitable grounds. It is essential to be sure that a water pipe ground is connected to ground through a metallic pipe and not plastic. The water in the plastic pipe will not substitute for a good metallic connection.

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MP-5	5	3000 W	$2,250
MP-6	6	3000 W	$2,700

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Model	No. Bays	Max. Input Power	Price
GP-1	1	1500 W	$350
GP-2	2	3000 W	$1,350
GP-3	3	4500 W	$1,800
GP-4	4	6000 W	$2,500
GP-5	5	6000 W	$2,900
GP-6	6	8000 W	$3,500

FM Medium Power Circular Polarization antennas.

Model	No. Bays	Max. Input Power	Price
SGP-1	1	3000 W	$650
SGP-2	2	6000 W	$2,450
SGP-3	3	8000 W	$3,500
SGP-4	4	8000 W	$4,300
SGP-5	5	8000 W	$5,100
SGP-6	6	8000 W	$5,900
SGP-6R	6	15000 W	$6,500

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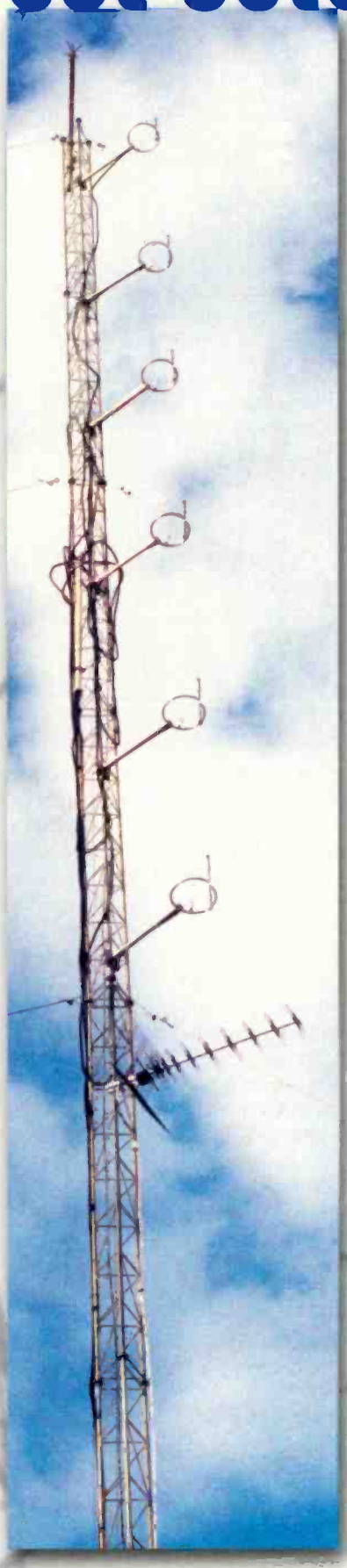

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Installation Profile

Lynn Duke (left), Chief Engineer, KROQ, Los Angeles and Scott Mason (right) Director of Engineering; West Coast, Infinity Broadcasting Corporation in the rack room in front of Klotz Digital VADIS 880 frames.

Klotz Digital 12-fader VADIS DC II control surface.

KROQ - The Road to Digital

KROQ's Studio R doubles as a production studio and live music performance on-air studio.

The year 2001 found Infinity Broadcasting Corporation's World Famous alternative rock station KROQ-FM faced with the end of it's current lease. Infinity carefully weighed its options and decided to consolidate its broadcast facility with cross-town sister station KRTH-FM. Faced with this move KROQ-FM had to decide on a technology platform for the new studios. Having made the decision to consolidate facilities, Infinity Broadcasting Corporation moved KROQ from its location in Burbank, CA, to an existing 'K-Earth' facility in The City of Los Angeles.

With an on-air date scheduled for September 2001, KROQ's engineers began modification of the existing K-Earth facility in the summer of 2001 and with that modification came the decision to switch from analog to digital.

"We knew we wanted to take the digital route. Setting up in the beginning I think we spent a lot of time evaluating what systems we would put into this radio station," said Scott Mason, Director of Engineering/West Coast for Infinity Broadcasting Corporation. "We had looked at our New York stations and thought, you know, New York is a tough market in this country and the digital system they chose (KLOTZ) seems to be working for them. It seems to have the functionality that we need—hence we pretty much made our initial decision to go with the equipment based on that and the fact that it made better financial sense."

Adds Lynn Duke, Chief Engineer of KROQ, "What KROQ had was a bunch of older analog equipment but when the opportunity came along to move, we couldn't really justify building a brand new analog facility in the year 2001, and the Klotz platform allowed us an affordable way to move to digital."

KROQ's studios, which consist of two on-air studios and two production studios—one of which doubles as a live on-air performance room—are faced with some unique challenges posed by its cutting edge programming. "The demands on the system in our air-studio are a combination of what you would see in a talk station and also in a music station," said Duke. Although primarily a music station, KROQ's Kevin and Bean morning show incorporates elements similar to those of a fast paced news/talk station. Live telephone talk, video links and a host stationed in Seattle, WA, transform the morning show into a daily live remote. "Because it has all the trappings and complications of being a talk station everything has to be in place and we still have to be able to play music and do that as though we were just a music station. It's a very busy operation in there!" Klotz Digital's VADIS AudioMedia platform provided the solution with two 24-channel DC II control surfaces for the on-air studios and two 16-channel DCII control surfaces in production all networked to 12 VADIS frames, providing KROQ's crew with the resources needed to meet their daily demands. ■

Installation Specs

Two 24-fader VADIS DC II control surfaces
Two 12-fader VADIS DC II control surfaces
Twelve VADIS 880 frames

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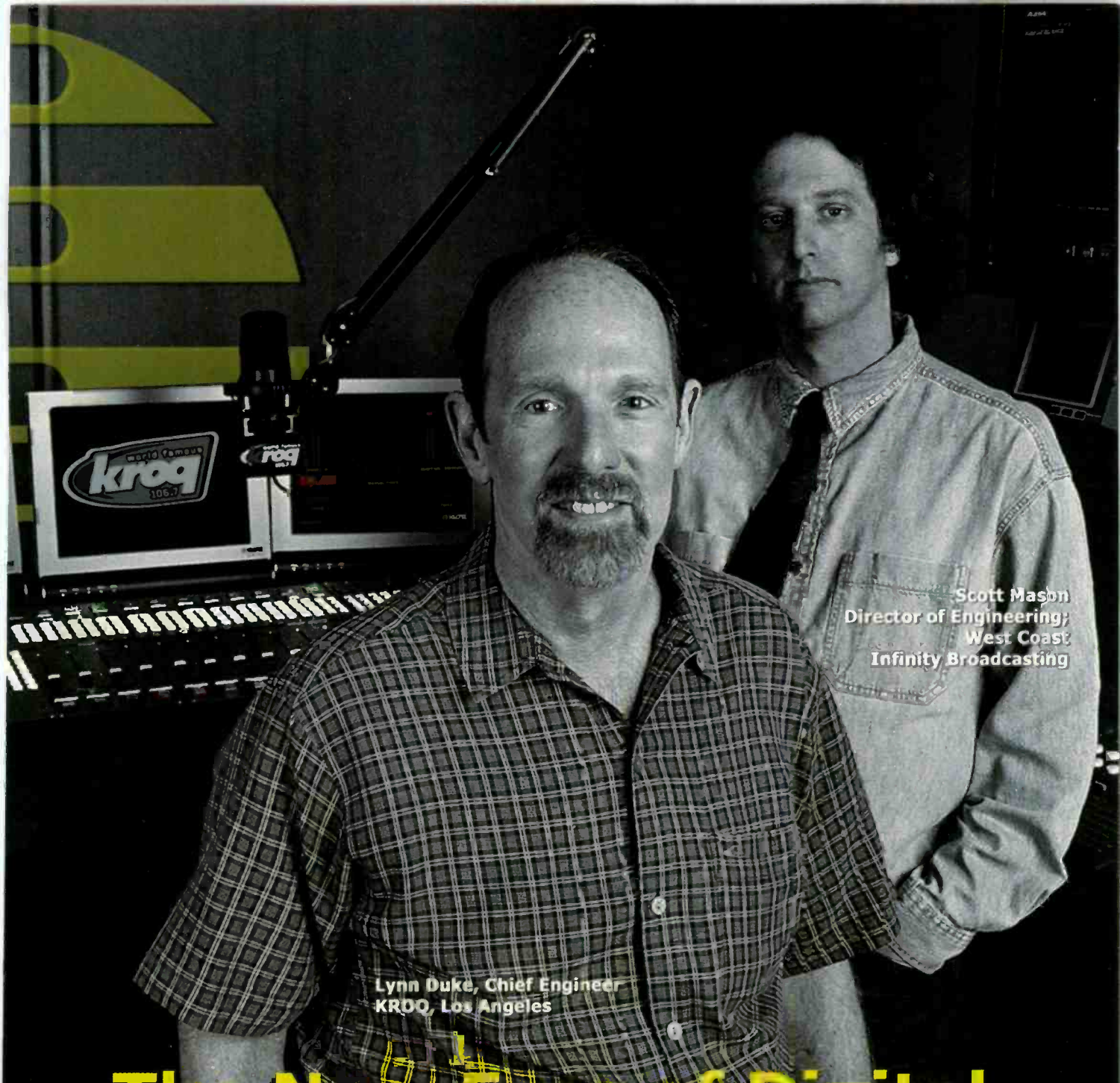

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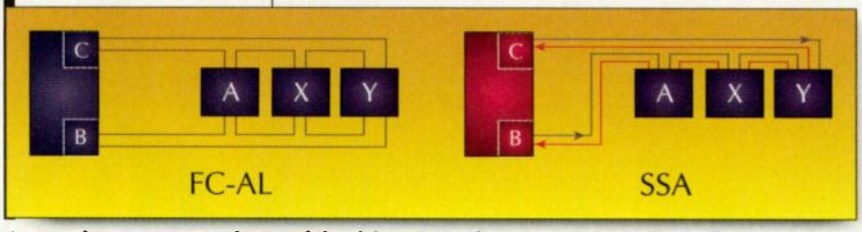
A look at arbitrated loop

By Kevin McNamara, CNE

Last month, I wrote about Fibre Channel technology, which establishes direct connections through the use of either a point-to-point, loop or fabric-based interconnection scheme.

Originally designed as a point-to-point networking technology using fiber-optic media, the development of Fibre Channel started in 1988 and became a standard in 1994. Unlike Ethernet topologies that require devices to share a common path, Fibre Channel topologies establish direct paths between devices allowing performance only limited by the speed of the connected devices. In addition to SCSI, Fibre-Channel can provide transport for a number of protocols including IP, ATM and 802.2 (Ethernet).



A, X and Y represent subsets of the drives in each system. FC-AL allows the administrator to isolate any drive from either controller (C or B). FC-AL can also maintain communications with any drive in the event of a failure.

Fibre-Channel can use one of three topologies: point-to-point, cross-point and arbitrated loop. The point-to-point topology, while the least flexible solution because it is limited to the connection of only two nodes, is useful for connecting a single server to single disk array. Using a series of interconnected intelligent switches, the cross-point topology provides the highest level of performance and scalability. Similar to the way modern telephone switching centers can route a call anywhere in the world based on a unique telephone number, a switching core called the *fabric* provides direct connections between the ports of two attached devices through one or a series of cascaded switches. Adding switches to a cross-point Fibre Channel network increases its performance because each switch provides additional paths.

Fibre Channel Arbitrated Loop or FC-AL has garnered the most interest and acceptance within the industry, primarily due to added support of copper-based media and multi-drop rings containing several devices.

Configurations

The FC-AL network can be set up in two possible configurations: daisy-chained (loop) or through a hub. In the daisy-chain configuration, the transmit port of one device is connected to the receive port of the next device in the chain. Due to the shared nature of loop topologies, only one device may send data at any time. Access to the loop is determined by winning an arbitration to become the *loop master*. Configuring FC-AL in a loop topology presents several limits to the performance of the network because performance is affected by the number of devices attached to the loop. The ability to make changes to the network is limited because the addition or removal of new devices or segments within a loop will bring down the entire loop.

The most common topology used in the deployment of FC-AL uses a hub that forms a physical star interconnection. If a loop or non-responding device appears, the FC-AL hub will bypass the failure, thus maintaining the operational integrity of the network. The simplest hubs provide only a means to bypass ports not attached to the loop, while the more advanced devices feature a wide range of management options that can automatically sense, correct and report problems to the network administrator, as well as providing tools to monitor and configure devices remotely.

Fibre Channel was originally developed as a means to separate network servers and disk-drive arrays without sacrificing performance. Storage specific interfaces, such a the Serial Storage Architecture (SSA) and the newer implementations of the SCSI standard, are still used extensively; however, Fiber Channel and especially FC-AL are faster, allow greater distance between devices and permit the ability to hot-swap devices without network interruptions.

How fast is FC-AL?

Inside a PC is a myriad of ribbon cables used to connect the disk drives to the PC's disk drive controller. The majority of PCs use a disk drive interface based on the IDE or SCSI standard. Ribbon cables are required because these interfaces transfer several lines of data over the individual wires simultaneously or in parallel. On the surface, it may seem that this would present the fastest method to move complex data, but for parallel transmission to work properly, all of the signals at the far end of the cable must arrive at the same time. Because the characteristics of each wire in that

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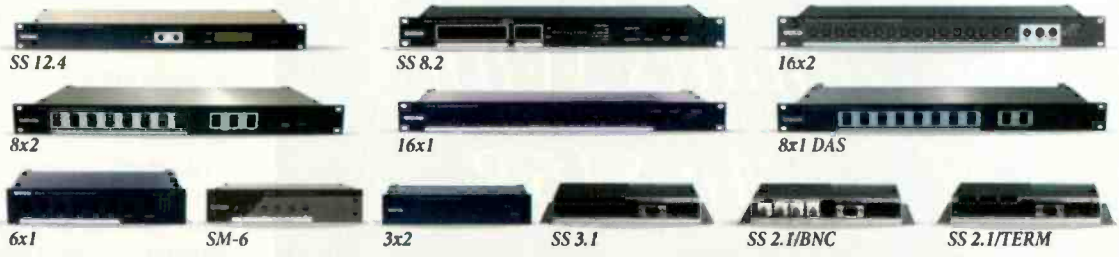

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Method	Maximum Data Thru Rate	Maximum Distance	Maximum Devices	RAID support
IDE	66.6MB/s	1m	4 per controller	Possible but rare
Ultra Wide SCSI	40MB/s (25m using more expensive high-voltage differential termination)	1.5m	15 per controller	Yes
Ultra2 LVD SCSI	80MB/s	12m	15 per controller	Yes
Fibre Channel	100MB/s (200MB/s with full-duplex)	30m over copper, 500m over multimode fibre, 10km over single-mode fibre	127 per arbitrated loop	Yes, with independent attachment to multiple servers

Figure 1. A comparison of Fibre Channel with other established data storage technologies.

cable may be different, signals can pass at different speeds, particularly if that ribbon cable is pinched or damaged. To make sure all of the data arrives properly, the controller waits to receive the data for each line, thus requiring it to operate slower by default. In contrast, interfaces such as FC-AL and SSA are based on a serial data communications method where data is transferred over a single media, such as a pair of copper wires or fiber-optic media. The speed is limited only by the type of media used.

Presently FC-AL supports a maximum data rate of 106.4MB/s per port. It is possible to assign a second port to each connection that allows for that data rate in both directions simultaneously (full duplex), thus increasing data throughput to more than 200MB/s. In comparison, the fastest data transfer speed offered in current or future versions of the SCSI standard is 160MB/s. SSA operates at a maximum throughput of about 40MB/s.

As a practical matter, the capable throughput of either interface is far in excess of what the highest performing disk drives currently available can achieve.

Cable distance limitations

Transferring data (or RF for that matter) over copper wire can present a challenge, particularly as the bandwidth and frequency of the signal increases. Factors such as signal losses and cross talk between wiring limit the cables ability to carry signals over long distances.

FC-AL can operate over copper wire connections of as far as 30m; however, distances of as far as 10km can be achieved with fiber-optic cabling. The maximum distance recommended for current versions of SCSI is 25m and 680m for SSA using fiber-optic cabling.

In FC-AL networks, any number of drives can be added and removed provided the maximum number of devices does not exceed 128. It is possible to cascade multiple FC-AL loops that could support as many as 16 million devices. Figure 1 compares several common formats.

FC-AL clearly makes sense for those instances where there is a need to provide fast and reliable access to external arrays of disk drives as is typical for digital broadcast storage/playback systems.

McNamara, BE Radio's consultant on computer technology, is president of Applied Wireless Inc., New Market, MD.

The Networks articles have been approved by the SBE Certification Committee as study material that may assist your preparation for the SBE CBNT exam.

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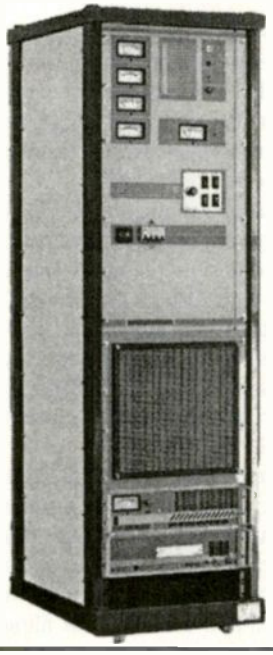

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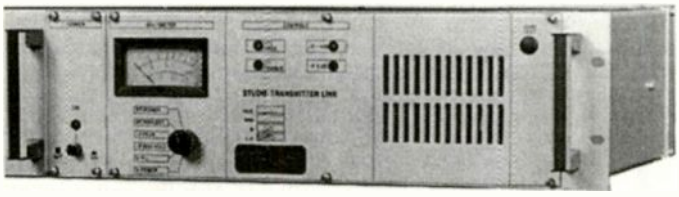

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FCC Update

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Broadcast auxiliary "purge"

By Harry Martin

In May the FCC announced that it is purging its files of 9,000 or more unidentified broadcast auxiliary licenses, including microwave STL facilities, remote pick-ups and inter-city relay stations. The FCC cannot match these 9,000 licenses with the main stations that operate them.

Most of the problem has been created by haphazard record keeping by the FCC. When main stations were sold, auxiliaries often remained in the names of the selling entities, many of which ceased corporate existence. Also, the call signs of main stations have changed, often several times, with no record being maintained of the auxiliaries that were affected. Then, when the FCC entered its auxiliary station database into the Universal Licensing System (ULS), all of the incorrect license data were entered into the system with no regard for the accuracy of main station call signs or licensee names. As a result, thousands of auxiliary licenses, although still in use, are not associated with main stations in the FCC's data systems. The Commission's solution is to rid its records of all licenses not claimed by July 1. Licensees must act quickly, or these licenses will be cancelled.

The best way to make sure your auxiliary licenses are not caught in the purge is by following the instructions in the FCC's May 10, 2002, *Pubic Notice*, DA 02-1094, which can be accessed at www.fcc.gov on the Wireless Bureau's Web page under "Headline Archive."

Pirates may walk plank

A federal court has agreed to again hear arguments about the constitutionality of the FCC rule forbidding pirate broadcasters from applying for LPFM radio licenses.

In February, a three-judge panel of the U.S. Court of Appeals for the District of Columbia invalidated the provision of the Radio Broadcasting Preservation Act of 2000 that prohibits anyone who has engaged in unlicensed radio broadcasting from applying for a low-power FM radio license. The Court deemed this character qualification provision unconstitutional under the First Amendment and the equal protection clause of the Fifth Amendment, because it targeted only unlicensed broadcasters but not other types of rule breakers—and because it failed to consider waivers for pirates who pled ignorance of the rules or renounced their pirate ways and tried to bring their operations into compliance with FCC rules.

The FCC persuaded the Court to rehear the February ruling *en banc* (by all eight judges of the D.C. Circuit Court of Appeals) by arguing that the decision "blesses a wholly unwarranted judicial intrusion into Congress's domain." According to the Commission, the Court improperly overstepped the boundary between itself and Congress by finding that additional persons should have been covered or excluded under the provision, which was promulgated as an amendment to the FCC's LPFM rules.

The order granting review *en banc* vacated the three-judge February judgment, which in effect breathes life back into the prohibition against pirates owning LPFM stations. That does not mean pirates-turned-LPFM-applicants are likely to get an opportunity to file LPFM applications before the case is reheard; the FCC has not scheduled a new LPFM filing window. Nor is this judicial activity likely to slow down the LPFM service. On May 23, 2002, the Commission issued a cut-off list of nearly 200 LPFM applications that are ready for processing. In a footnote to the cut-off list, the FCC noted that its determination that the listed applications are all "acceptable" is not "the result of the staff taking adverse action with respect to a conflicting LPFM application that failed to satisfy the Commission rules regarding [pirates]"—in other words, the Commission seems to be confident that the cut-off list does not include any pirates or potential pirates.

Streamers' hopes dashed

A June 20 ruling by the Librarian of Congress, which has ultimate authority for administering U.S. copyright laws, dashed the hopes of Internet radio stations by requiring webcasters to pay substantial royalty fees to record companies. The new rates for Internet-only webcasts were reduced from the previously approved 0.14 cents per song per listener to 0.07 cents. The rate for broadcasters streaming their signals on the Internet will remain at 0.07 cents.

Martin is an attorney with Fletcher, Heald & Hildreth, PLC., Arlington, VA. E-mail martin@fhhlaw.com.

Dateline:

Renewal applications will be due for all stations in Washington D.C., Maryland, Virginia and West Virginia in June 1, 2003. For stations in these locations, pre-filing public notices will have to be broadcast beginning March 1, 2003. This will begin the next renewal cycle, which will extend through 2006.

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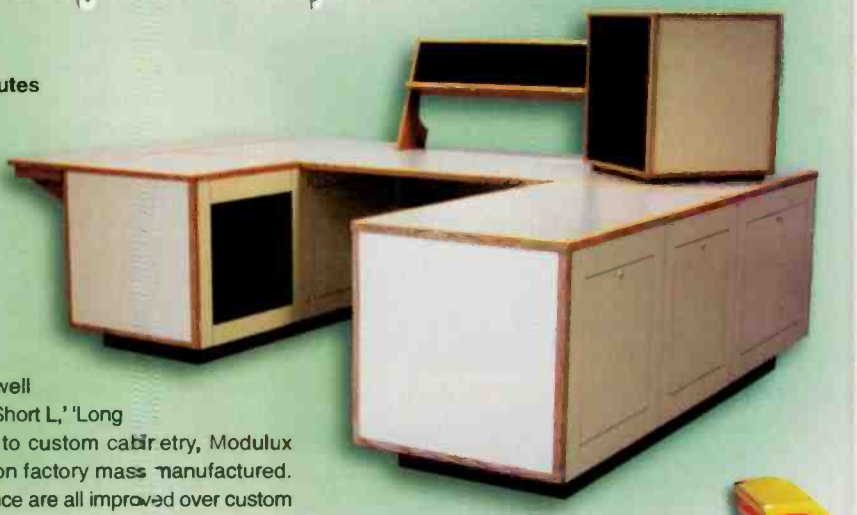

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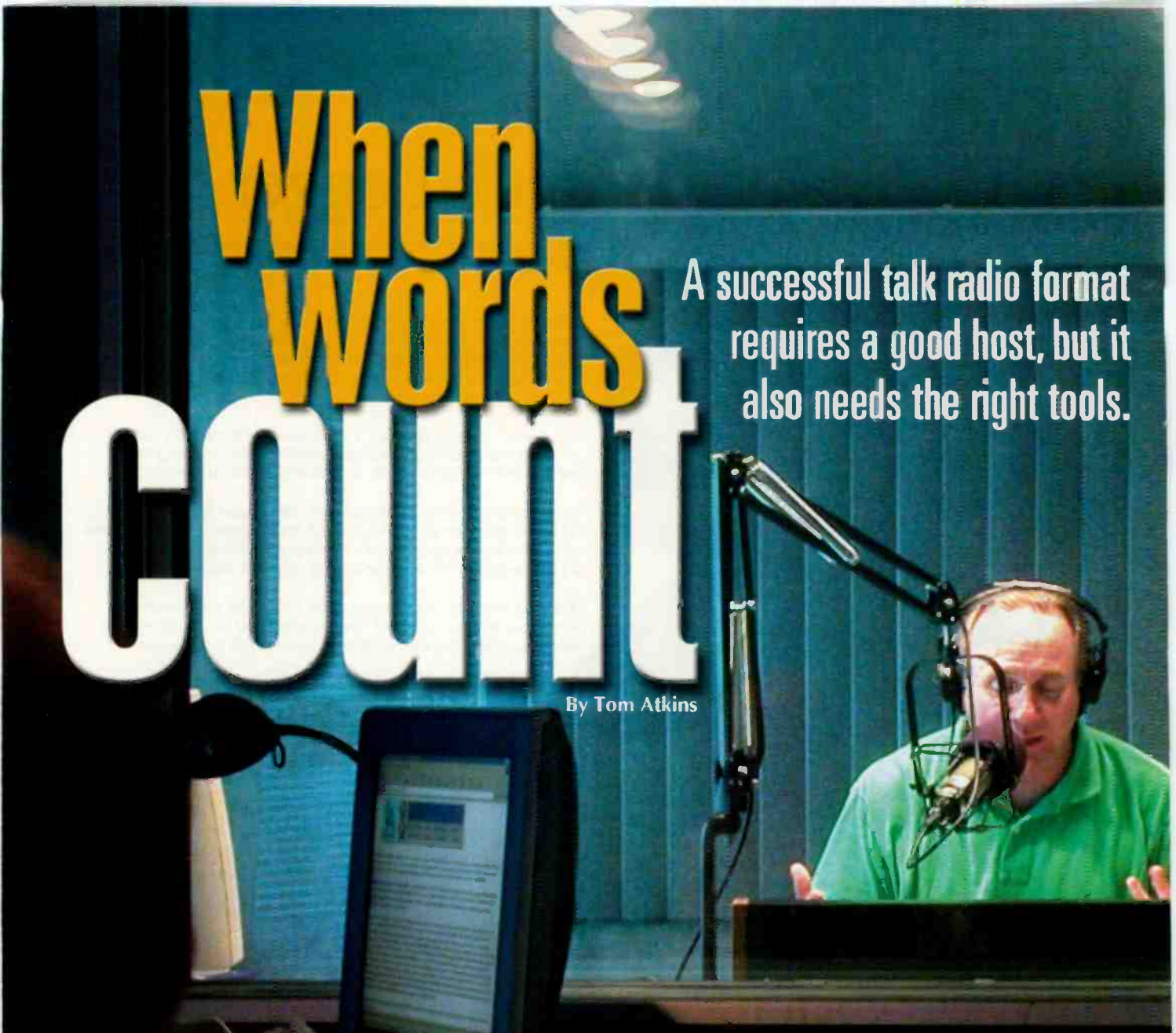
When words count

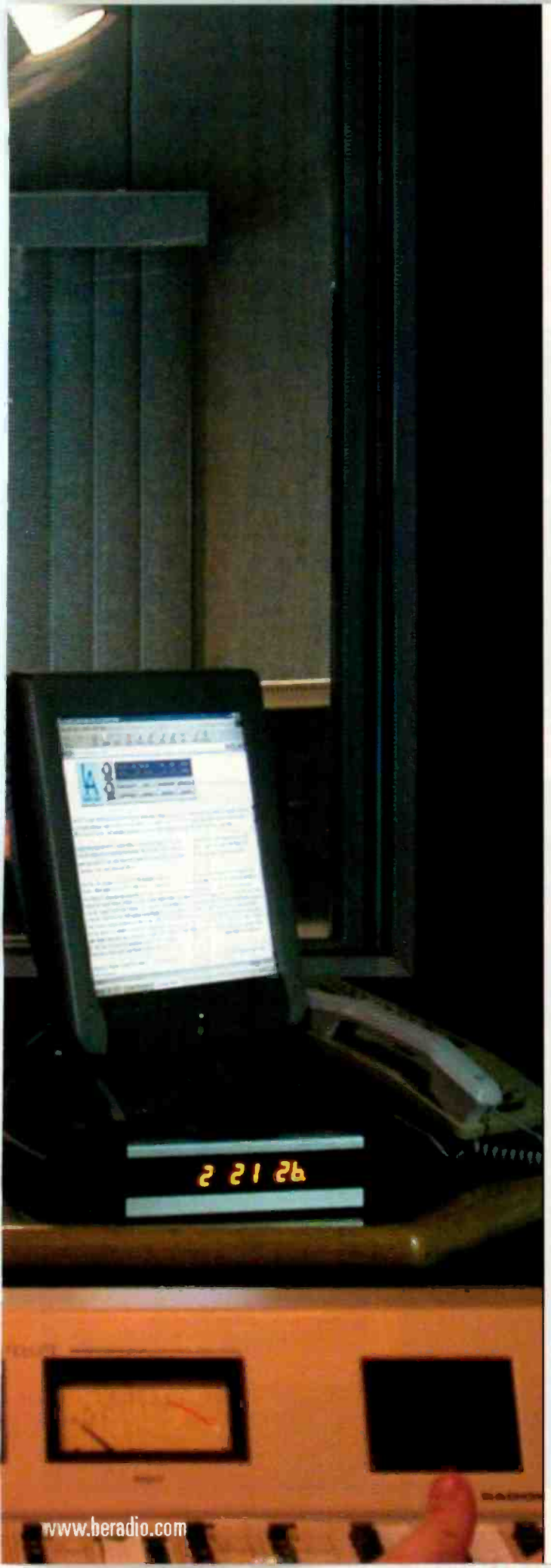
A successful talk radio format requires a good host, but it also needs the right tools.

By Tom Atkins

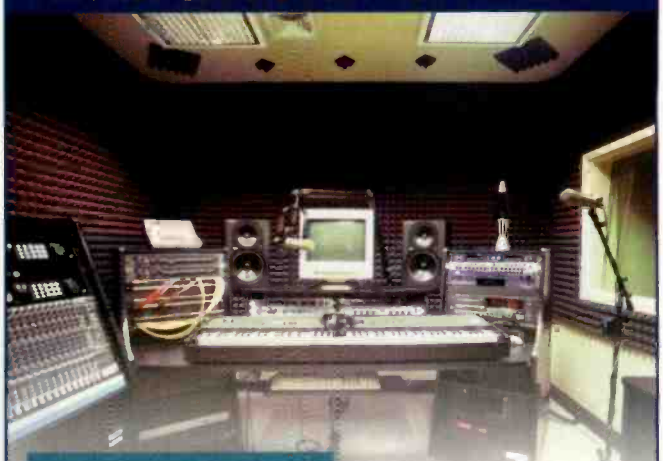


Whether it's sports, news or general talk, all that jabber presents some interesting challenges to the engineer responsible for maintaining a good and intelligible sound. Some of the more common problems have easily obtainable solutions in the talk radio venue. A station's sound is its signature, and a format based on the most versatile instrument—the human voice—presents its own challenges to maintain the quality sound with a variety of voices.

The first component of the signal chain is the microphone. This single piece of equipment can make the most difference in obtaining a quality sound. One common problem is that the more microphones that are open in a room, the greater the chance for unwanted sound reflections from walls, windows, tables and chairs. When combined these reflections create a hollow sound that sounds like the program is being produced from the bottom of a well. This problem is amplified by guests that speak softly and sit too far from the mic. Acoustic treatment can help reduce the unwanted reflections, but this approach doesn't eliminate the problem. In reality, a perfect acoustic room is not practical or economically feasible. Education is the first line of defense for poor mic technique. This is accomplished by having a good cardioid mic, flexible mic booms and well-educated talk show hosts and producers.



ART AND ENGINEERING COME TOGETHER...



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When words count

A directional microphone can reduce the unwanted reflections by attenuating the sounds coming from of-axis sources. While a tight directional pattern can be used, guests that are not comfortable on a microphone may accidentally move outside the mic's pickup area. The trade-off is to install mics with looser patterns for the guests, followed by instruction of basic mic technique.

One weapon in reducing the well-like sound is an automatic microphone mixer. The Shure FP410 or SCM810 are two examples. These mixers will attenuate microphones not being used and are highly transparent. When set up properly, the hollow sound is minimized if not completely eliminated. The SCM810 also has a microphone mute connection for each input, which is useful as a cough switch. The mixer is initially set and rarely needs adjustment no matter what type of guest speaker you have. There are rare occasions where guests do not have good mic technique at all. However, even in these circumstances, the resulting audio with the automatic mixer is still far superior than without. Models such as the FP410 are ideal for remote talk shows. Because it uses a noise-adaptive threshold, it takes into account constant room noise and only turns on the microphone spoken into and does not randomly turn on channels with room noise. This also reduces feedback on a PA system used at a remote location.

Microphone processing, when used properly, can help achieve a good overall sound. We tend to use one compressor/equalizer combination for all the microphones instead of the traditional one

Producing a talk show from the road is now a simpler task thanks to POTS and ISDN codecs and their associated data channels. Here, the Carey Brothers of *On the House* and their guest Dom DeLuise use a Comrex Envoy.

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processor per microphone method. A submix of the microphones is passed through the processor. With an automatic mic mixer, the processor can be placed directly on its output. Depending on a station's configuration, it may be possible to route the mics into their own mix bus and process through a patch point or via a return feed. This sounds like a long path for the audio to travel but the results will prove to be satisfactory. When using multiple microphone processors, particularly in a small space, the unused microphones can increase the gain of the unwanted, indirect sound. With multiple open mics, this can quickly result in the hollow sound I mentioned earlier. Setting a gate or expansion threshold on the processor can reduce or eliminate this, but it may need to be set at a level that while high enough to eliminate the hollow effect, it may produce unwanted effects when the mic is in use. Soft-spoken people sound like their syllables are being clipped. This problem is eliminated with one compressor. There are many good processors on the market, and it will depend on the sound you and the station are trying to achieve as to which one will be right for your station.

Go to the phones

On the other side of the talk-radio conversation is the caller. Although your budget will determine what type of telephone hybrid you use, a top-of-the-line one offers digital signal processing, auto nulling, a gain-controlled caller output, caller equalization, and a variable, full-duplex/half-duplex control. The typical talk format spends about 40 minutes per hour talking with callers. This can easily justify the expense of a quality hybrid. The DSP hybrid can achieve superior send-audio rejection, making the caller audio cleaner without the talk show host audio sounding like it has been phase-shifted and flanged. A consistent caller output level is critical in a good-sounding talk show. If you think of all the different types of phones there are and the paths they take to get to the station, it is easy to see why the caller level can vary so much. If anything, the consistent level of audio from the caller will relieve the show's producer from having to adjust the caller audio for every call. Although equalization controls for the caller audio may seem superfluous, it can help if you have especially noisy lines at your station. Don't bother trying to obtain full-fidelity sound from

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M Antenna Certification Workshop
Thursday, September 12, 8:00 am–4:00 pm

- A Segment Presenters–Ronald Rackley, duTreil, Lundin & Rackley, Inc.; Benjamin Dawson, Hatfield & Dawson
- Segment Presenters–Tom Silliman, ERI Inc.; Surette, Shively Labs

nnual workshop, updated for 2002, focuses on antennas–AM and FM– addressing operation and maintenance from a practical perspective. If you think tuning and maintaining a broadcast antenna system requires years of experience performing "black magic", think again! Let the experts show you how to easily troubleshoot antenna problems and, more importantly learn how to anticipate potential e before it occurs.

Digital Radio Certification Workshop
Friday, September 13, 9:00 am–4:00 pm

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- Scott Stull, Director of Broadcast Business Development, iBiquity
- Patrick Walsh Vice President, Wireless Data Business Development, iBiquity
- Tom Wroblewski Lincoln Mercury Engineering
- Glynn Walden, Vice President, Broadcast Engineering, iBiquity

If you are in Radio you need to be thinking about digital broadcasting. This workshop will feature updates on IBOC and its benefits, the nuts and bolts of IBOC implementation, and the latest information on how to go digital for minimal cost.

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- Instructor: John Bisset, Harris Corp.

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When words count

the caller. Plain old telephone service (POTS) lines are capable o 300Hz to 3kHz ban width. You can sometimes get a better response, but the typic response is small. The best you can do is make what you a receiving sound better within the constraints of the telephor company's bandwidth. The ability to adjust the hybrid from fu duplex to half-duplex or anywhere in between can help to reduce unwanted noise from callers while the host is speaking. A variable adjustment allows you to adjust the hybrid's ducking response of the caller's audio from none to all the way. It will also help when callers tend to be argumentative and the host needs to maintain control of the show. The host can maintain a level voice and easily override the caller.

For the best results when conferencing multiple phone calls, us separate hybrids. Most automatic nulling hybrids will adapt to tw phone lines when they are paralleled as long as the call directo issues a re-nulling command to the hybrid when the second lin is combined with the first one. Mashing multiple lines togeth works, but as more lines are added the overall fidelity become worse. If multiple calls are taken at the same time, invest in the proper tools and install multiple hybrids.

Seven steps to better-sounding talk shows

1. ***By doubling the distance from the source to mic you reduce the audio level by one-half.***
   Keep this in mind when positioning mics and speakers to avoid unwanted sound pickup and comb-filtering effects.
2. ***Avoid giving guests headphones.***
   Headphones tend to make guests speak more softly and focus on the sound of the voices instead of focusing on what is being said.
3. ***Install a telephone speaker in the talk studio.***
   The speaker's level can be set to introduce minimal bleed into the open microphones, but still provide a suitable level for guests to hear the callers.
4. ***Provide a separate headphone feed for the host and guests.***
   If the guests are given headphones, do not provide the same feed that the host receives. The host headphones can be supplied with communications from the show producer without distracting the guests.
5. ***Maintain clean site lines.***
   If guests are made to feel comfortable, they will speak more freely and openly. Visual clutter from too many mic booms, monitors and other equipment makes them feel closed in.
6. ***Instruct everyone about proper mic technique.***
   Experienced hosts should already know this, but a refresher usually helps. Don't inundate guests with too much information; give just enough to keep them on mic.
7. ***Solve acoustic problems acoustically.***
   Mic placement and technique are the first step in good sound. Avoid the trap of installing more electronics to overcome an acoustic problem. For example, instead of filtering the air conditioner rumble it should be eliminated at the source. ■

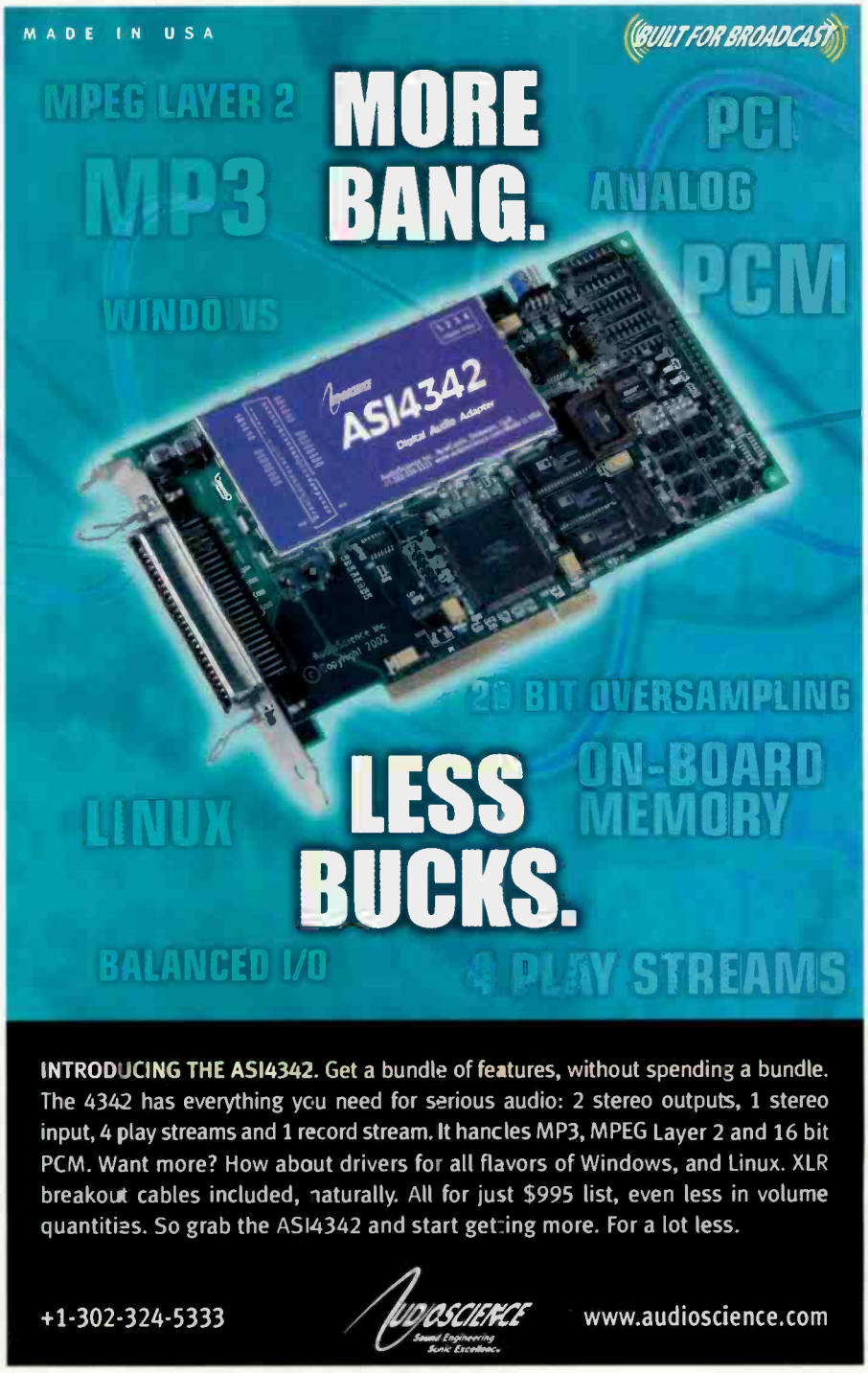
The host position should have clear sight lines to the guests, call screener display and the show producer.

It should be second nature for people in the communications business to communicate and communicate well. All too often, communication to the talk show host is sacrificed. This is a crucial part of the talk show equation. First, some form of call screener software should be employed. This can be as simple as two computers linked via the RS232 ports running a terminal emulator, to a full-blown network system running commercially written call-screening software. Call Screener for Windows from Condron Broadcast Engineering and Assistant Producer from Telos Systems are two call-screener programs. The software communicates with the call director to show which lines are on hold, which lines are on-air and which lines are inactive at the moment. Most software packages are made to run on a computer network so the information entered into the system is immediately available to the talk show host. The networking can also be accessed from a remote broadcast using dial-up networking.

The second most important item in communicating with the talk show host is IFB. Simple IFB systems can be constructed using a relay that when activated by the producer, interrupts the audio in one ear of the host's headphones. Commercial studio intercom systems are available. Many audio routers have the ability to function as intercom/IFB systems as well. In our configuration, the producer can talk to the host whether he is in the studio or on a remote. During a remote, the producer sees no operational change once the remote site dials in to the IFB through a POTS line. Another benefit of using an intercom system is that it is based on a cross-point switcher and any one of the 32 intercom stations can talk directly with the host. The newsroom can now alert the host of late-breaking items without leaving the room.

Talk radio is a format with a uniqueness that is all its own. The timely delivery of information is vital, and the communications between show staff, listeners and the host are crucial. Out of the 40 or so minutes of talk each hour, any silence can be deafening. Then it is up to the technical staff to provide the tools so the conversation can continue effortlessly and without interruption. Hopefully these tips and techniques will keep your talk station from experiencing silence for some time to come.

Tom Atkins is director of engineering for Entercom Communications, Buffalo, NY.



ON LOCATION

OLD-TIME RADIO

In a Modern Era

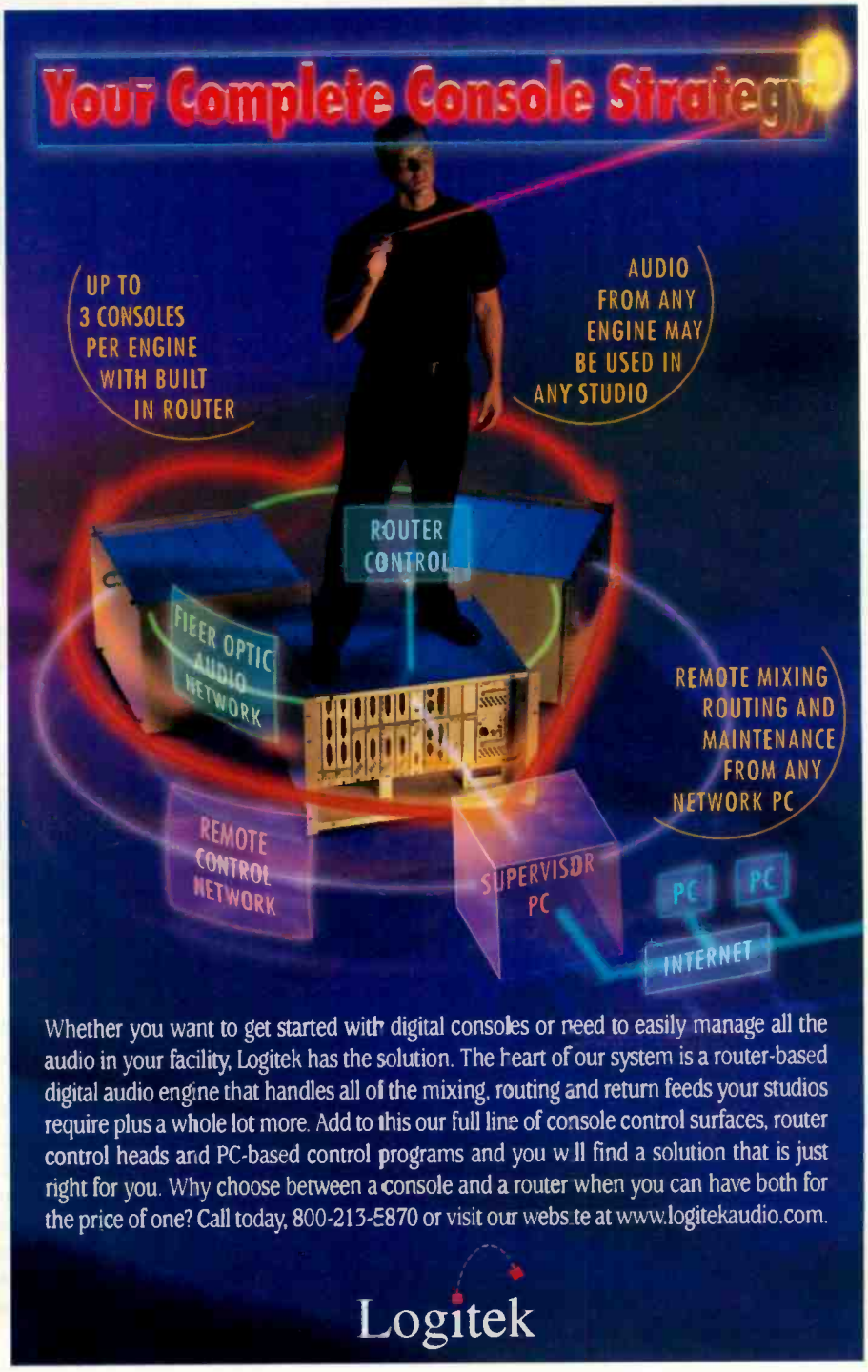
By Ron Bartlebaugh, CBNT

A part of radio history is preserved in a museum that also recreates the golden age of radio.

The spirit of the live radio variety shows that were so popular in the 30's and 40's is captured in the WCLV production. This photo, from the collection of Larry Kass, shows Ruth Etting, a popular radio singer of the 30's as she sings into a microphone that is now part of the John Milton Williams Museum.

The audience is seated. The actors are standing by and the Theater of the Air Chorus is in place. The sound effects man is ready to go. The mighty Wurlitzer pipe organ sits center stage beside its companion 1927 Steinway Duo-Art grand piano. The curtain's going up. It's time for The Mighty Wurlitzer Radio Hour program to originate live on WCLV-AM and FM from the home of the John Milton Williams Museum of Radio Broadcasting History. Perhaps America's only live musical variety program on the air takes audiences back to the Golden Age of radio.

The radio program was the idea of WCLV President and long time radio voice of the Cleveland Orchestra Robert Conrad, and accomplished physician and organist/pianist Kass. Conrad has been involved in fine arts radio for several decades. Larry

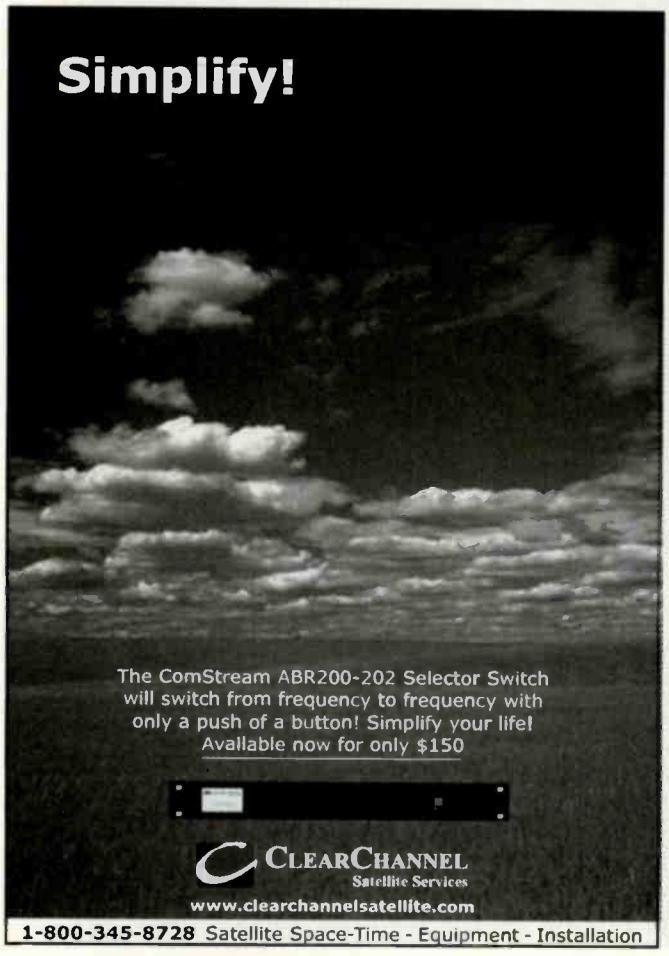


Kass started as a classical pianist at age five and made his radio debut on an amateur show on WSPD in Toledo, OH. At the age of 15, Kass was the piano soloist with the Toledo Orchestra in Gershwin's Rhapsody in Blue. Cleveland's legendary radio celebrity, Wayne Mack, wrote and directed The Mighty Wurlitzer Radio Hour programs for several years beginning in 1993. Mack's radio career began in 1931 on WJAY in Cleveland. Over a period of 68 years, Mack wrote thousands of original radio scripts and produced and directed local and national radio shows for WGAR in Cleveland and also for the Columbia Broadcasting System. Professional actors, vocalists, instrumentalists and legendary announcers have been used on The Mighty Wurlitzer Radio Hour shows since 2001.

The Mighty Wurlitzer Hour takes to the airwaves.

More than a dozen of the fast moving programs, each containing more than 20 songs, were taped before a live audience and tape-delay aired on WCLV before the show went live to air in October of 2001. Radio history was then made in northern Ohio when The Mighty Wurlitzer Radio Hour played before a live studio audience and was broadcast simultaneously over WCLV AM/FM as well as on www.wclv.com. The program was a musical variety show that celebrated the Golden Age of Radio as part of the dedication of the John Milton Williams Museum of Radio Broadcasting History. The museum is an exhibition of rare microphones and one of a kind memorabilia from the early days of radio broadcasting through the Golden Age of Radio in the 1930s and 1940s. Each show brings back memories of live radio in a high-class format that includes classical music and the best of vintage American popular music by composers such as Irving Berlin, Cole Porter and Glenn Miller. It is said that the program is the way radio was intended to be. A second show has aired live since the October 2001 program and several more are planned. The show scheduled for June 30 was to have a patriotic theme as it will air close to Independence Day. The fall program, scheduled for October 6 at

Two Shure SM81 mics are set up in an X-Y configuration to pick up the chorus. An Electro-Voice RE-20 is mounted below the X-Y to act as a middle fil and to pick up the actors' voices.



The Wurlitzer organ and Steinway piano provide the instrumental accompaniment during the performances.

3 p.m., and the Christmas program, scheduled for December 15 at 7 p.m., will each contain a seasonal theme. All shows, beginning with the October 2001 airing, were or will be performed before a 100-person studio audience and broadcast live over WCLV-AM/FM and online at www.wclv.com.

The Mighty Wurlitzer Theater pipe organ's life began in 1928 as it entertained the opening night audience at the opulent Plaza Theater in Kansas City, MO. Even though the organ remained in nearly pristine condition over the years, it was restored starting in 1965 and finished in 1987 by Ronald Wehmeier of Cincinnati. Kass, and architect-wife Sara, purchased the organ in 1987 and subsequently had it installed in their home in an area that was specially created by Sara. The 1927 Steinway grand piano, which is positioned adjacent to the organ console, was added in 1994 and can be played from each manual and the pedal keyboard of the organ. The Wurlitzer has two manuals and 19 ranks of pipes. Its 1,315 pipes are contained in two subterranean chambers that are 15-feet high and kept at 70 degrees F and 45 percent humidity to maintain proper tuning of the organ. The sound of the organ travels through swell shades located in the floor above the chambers. The use of the shades provides a quality acoustical alignment of the organ sound. The opening and closing of the swell shade's louvers determine the volume of the organ and are controlled by the organ's pedals. A rare 1927 Wurlitzer vibraphone is located between the organ console and the swell shades and can be frequently heard blending with the wide dynamic sounds of the organ as it all transverses to the audience through a specially designed acoustically correct room. The organ has all of the special sound effects that were used when instruments of this type accompanied the screening of silent movies. Some of those effects include clanging bells, boat whistles, and automobile horns. Other special effects include a bird whistle, a fire bell, a quacking duck and a train whistle. The chambers also contain many orchestral and percussion instruments that are played from the organ's console.

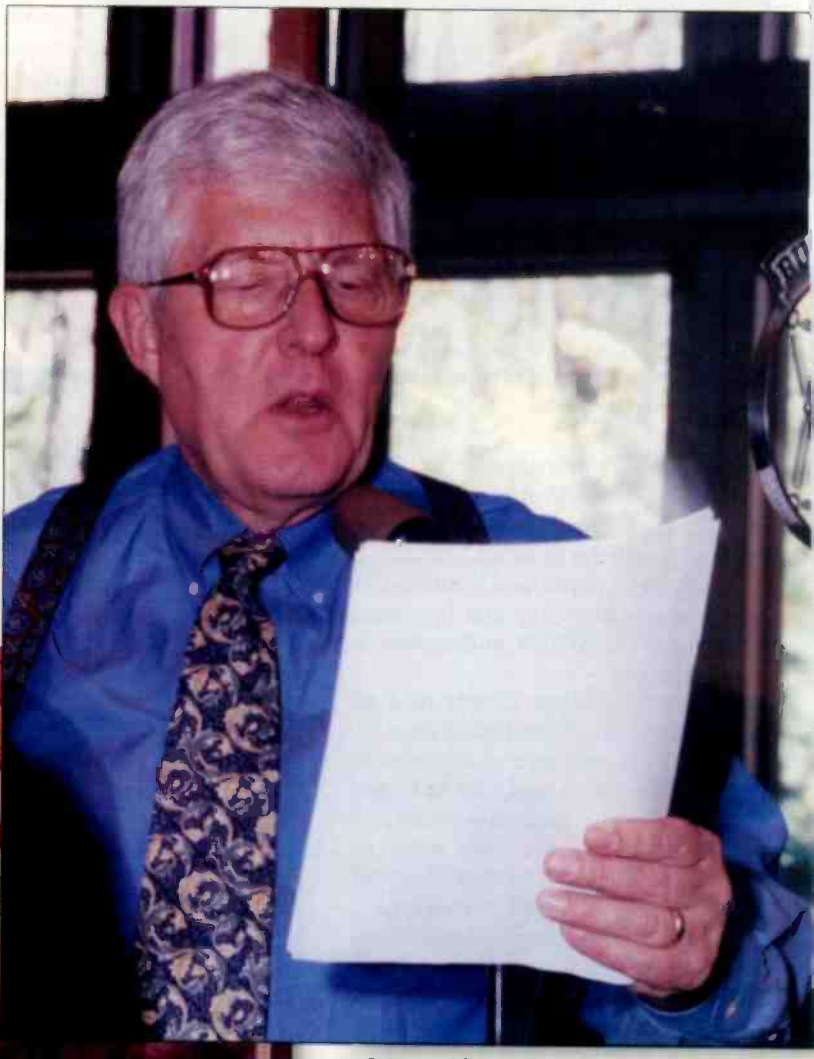
Capturing the sound

Two AKG 225 microphones are located above the swell shades in a spaced pair for miking the

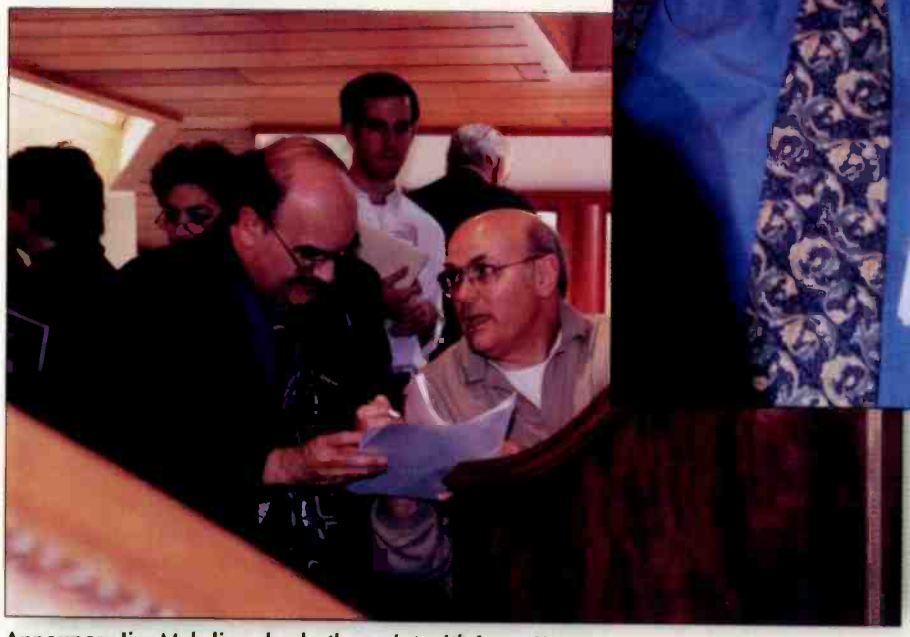
organ for broadcast. These microphones were specifically chosen for use by Kass because of their low frequency response and capacity to reproduce the smooth mellow mid range sounds of the organ. Two Shure SM81 microphones are used on the stage in a X-Y pair for middle fill of the organ miking as well as for miking the Theater of the Air Chorus. An Electro-Voice RE-20 microphone is located below the x-y pair for filling in the middle of the X-Y pair as well as for miking the actors. A Shure SM57 microphone is used by the announcers. The Steinway grand piano is miked by using two Audio Technica AT4031 microphones in a spaced pair configuration that are located about three feet from the piano.

No prerecorded sound effects are used on the show. All sound effects used are created by newly built replica of an old-time sound effects box complete with a squeaky hinge, slamming door and a resonating chamber that is used to create a knock on the door effect. Program engineer James Patrick Murphy uses two Shure SM57 microphones for miking the sound effects box; one above, and one below the box. Everything is close miked due to the limited space of the room.

A Mackie 1604 16-channel mixing console derives the mix that is fed to WCLV via a Telos Zephyr ISDN codec. The program is also recorded on multiple media formats including mini-disc, hard drive and DAT. Compressor-limiters are not used in favor of manual gain riding. A pair of self-powered JBL EM15 speakers mounted on stands provide the public address system for the audience.



WCLV president Robert Conrad serves as the program's host. Vintage mics from the museum's collection are set up in front of the performers for dramatic effect. Conrad's actual mic is a Shure SM57, which is visible behind his script.



Announcer Jim Mehrling checks the script with Larry Kass.

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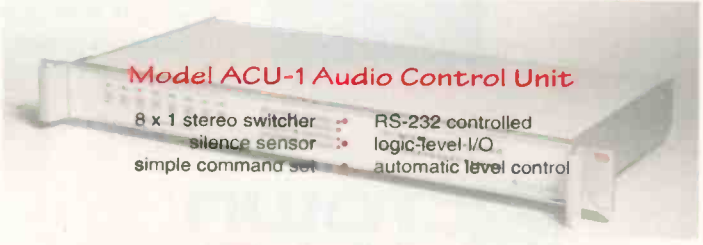

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A taste of history

Many of the broadcast microphones are hidden behind antique microphones from the on-site John Milton Williams Museum of Radio Broadcasting History to enhance the perceived effect of an old time radio theater. The museum is just down the hall from the Mighty Wurlitzer Radio Hour studio. Its collection was originally part of a display within the NBC Exhibit Hall of the RCA Pavilion at the 1939 New York World's Fair. The collection was later rescued from demise by Joseph D'Agostino and later entrusted to his close friend John Milton Williams who was a successful radio announcer, actor and a collector of radio memorabilia. Kass and his wife acquired the entire collection in 1999.

One of the nearly two-dozen microphones that are on display is a circa 1930 Western Electric condenser microphone with the Columbia flag fixed to the long dimension of the microphone. Another is a telephone-type ring microphone used by Dr. Frank Conrad on 8XK (later becoming KDKA) in 1919. Other items of interest on display at the museum are the original NBC chimes that were used in 1922 at WGY, Schenectady, NY.

Artifacts relating to early wireless communications and telegraphy that were collected by D'Agostino and Williams are also on display, including a rare DeForest single wing Audion tube circa 1927 that, as simple as it is by today's standards, causes one to marvel at the "new" technology of that era. A Marconi valve circa 1915 sits proudly on display in the museum as another memory of days long past.

Many of the same microphones that are on display in the museum were once used by actors and singers during the Golden Days of radio on programs such as the Atwater Kent Hour, The Eveready Hour and The Lux Radio Theater. The singers and actors on The Mighty Wurlitzer Radio Hour perform in harmony with the heart and soul of the Wurlitzer pipe organ to bring life to the memories of those Golden Days. It is a touch of days long past, but not forgotten, thanks to The Mighty Wurlitzer Radio Hour, America's only live musical variety program on the air, and the John Milton Williams Museum of Radio Broadcasting History.

Bartlebaugh is director of engineering for the WKSU stations, Kent, OH, and president of Audio and Broadcast Specialists, Akron, OH.

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The digital nulling circuitry is so effective that a console mix minus is not required.

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The full rear-panel remote control interface allows any console complete hybrid control. With the DI-2000 calls can ring-in, be answered, put on hold, screened and dropped, all via your console's channel on/off buttons. No external "black boxes" are needed!

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And for those in search of a good, basic analog hybrid—Radio Systems still makes the classic and dependable Symetrix TI-101.

The Innovator Award

"A mind once stretched by a new idea never regains its original dimension."

Oliver Wendell Holmes

Through great ideas come great results. The early pioneers of physics, acoustics, electronics and telephony forged their ideas through innovative thought. The same is true today with individuals who further the science of radio broadcasting.

The Innovator Award was created to recognize the individual who has made an outstanding contribution to the radio broadcast industry through the development, design and introduction of technology that further advances the science of radio broadcasting. The recipient of the Innovator Award has shown unique vision and understanding of the radio broadcast industry. This insight has helped the recipient to develop products and services that have shaped and continue to evolve the technology of radio broadcast engineering.

The five people profiled on the following pages have been nominated as candidates to receive the first *BE Radio* Innovator Award. All of them have made important contributions to radio broadcast engineering. They represent the spirit of ingenuity. These individuals have demonstrated exceptional creativity and inventiveness in their work.

Their collective work spans the entire radio broadcast signal chain, covering all aspects of capturing, storing, modifying and transmitting sound to radio listeners. It is likely that you have used a product that was the result of the efforts of at least one if not all of the nominees.

Please read the nominations on the next few pages and consider the accomplishments of each of them. Consider the contributions of each and how those contributions have augmented and propelled radio forward to the next level. Once you have considered each nominee, please cast your vote. The results of the Innovator Award will be announced at the NAB Radio Show in Seattle in September and in the October issue of *BE Radio*. The nominees are listed alphabetically.

Send your vote to us at beradio@primediabusiness.com, use the online ballot at www.beradio.com, or mail your vote to *BE Radio* Innovator; 9800 Metcalf; Overland Park, KS 66212.

—Chriss Scherer, editor

Kevin Lockhart, CEO

Prophet Systems Innovations
Ogallala, Nebraska

Accomplishments:

Kevin Lockhart is the founder and CEO of Prophet Systems Innovations, an Ogallala, Nebraska-based company that produces digital automation systems for the broadcast and entertainment industries.

Lockhart was born in North Platte, NE, on October 12, 1962. He attended Ogallala Public Schools, graduating in 1980. He studied business at the University of Nebraska at Lincoln. Lockhart was enlisted in the U.S. Army from 1986 to 1989, serving as a helicopter crew chief and attaining the rank of E-4.

A member of a longtime broadcasting family, Lockhart literally grew up in the radio industry. Over the years, he gained experience in all areas of the business, working as a disc jockey, sportscaster, engineering technician, sales representative and manager. Lockhart's unique combination of radio experience and technical expertise led to the creation of completely new technology. He is a pioneer in the digital era that has changed the face of broadcasting.

In 1989, Lockhart's father, Ray Lockhart, was looking for a way to replace outmoded and unreliable analog equipment at the family's radio stations in Nebraska and Colorado. Kevin Lockhart designed a system that stored audio directly on computer hard drive, and Prophet Systems was born.

Since then, Kevin Lockhart has directed development of all broadcast products, which have included Audio Prophet, Audio Wizard, Wizard For Windows, and NexGen Digital Broadcast. Prophet Systems broadcast systems are installed at 1,409 radio stations worldwide. The company has grown from one-full time and one part-time employee to over 110 employees.

Prophet Systems' central file server concept, coupled with the deregulation of radio station ownership in 1996, established the company as the leading digital automation provider in radio group consolidations. Capstar Broadcasting Group purchased Prophet Systems in 1998. Prophet Systems is now a division of Clear Channel. Users of Prophet Systems' technology include Rick Dees and Rush Limbaugh.

Awards, Honors and Distinctions:

Kevin Lockhart, 2001 Entrepreneur of the Year; Nebraska Center for Entrepreneurship

Prophet Systems Innovations, 2001 Outstanding Industry; Nebraska Diplomats, Dept. of Economic Development

Prophet Systems Innovations, 2001 Best Exhibit; International Association of Amusement Parks and Attractions

The Innovator Award

Geoffrey N. Mendenhall, P.E., Vice President, Advanced Product Development

Harris Broadcast Communications
Mason, Ohio

Accomplishments:

Geoff Mendenhall has been involved with the design of broadcast equipment for more than 35 years. Mendenhall graduated from Georgia Institute of Technology with a degree in electrical engineering. While at Georgia, Geoff designed, hand-built, and FCC type-accepted, WREK, the institute's student FM station's 425W FM broadcast transmitter, kicking off his broadcast career.

As the broadcast industry's leading expert on FM transmission, Mendenhall has contributed to improvements in the technical quality of FM broadcast transmitters for over 25 years. First known for the development of the Harris MS-15 FM exciter in 1976, followed by the Broadcast Electronics FX-30 in 1980, the BE FX-50 in 1989, the Harris DIGIT CD, all-digital FM exciter introduced in 1994 and most recently the new Harris DEXSTAR IBOC exciter. Each of these exciters, in its own time, became the industry standard. Today, more than 10,000 FM exciters on the air worldwide, carry Geoff Mendenhall's design innovations.

Mendenhall has also had a major impact on the design of modern FM transmitter power amplifiers, including many innovations in high-efficiency, high-power, single tube, RF amplifiers and solid-state RF driver systems. His work on high-power amplifier input and output circuits have improved the bandwidth of FM transmitters significantly, making them nearly transparent to the FM signal from the exciter. He more recently has pushed solid-state technology to the point were a 10kW solid-state transmitter is now as affordable as a transmitter with older tube technology.

Some of his key contributions to the FM broadcast industry include the following:

- Introduced circuit enhancements such as the TCXO, dual-speed phase-locked loop, ultra-linear modulated oscillator, and balanced composite baseband input to broadcast FM exciters.
- Brought the first totally digital FM exciter with digital audio input and uncompressed, 950MHz, digital STL to market.
- Technical papers and chapter contributions to broadcast texts.

Awards, Honors and Distinctions:

Recipient of the 1999 NAB Radio Engineering Achievement Award
Holder of four U.S. patents for broadcast equipment innovations
Registered Professional Engineer (Illinois)
Senior Member of IEEE
Association of Federal Communications Consulting Engineers (AFCCE)

Eugene Novacek, P.E., President

ENCO Systems
Southfield, Michigan

Accomplishments:

Eugene Novacek, P.E. founded ENCO Systems in 1983, after completing his undergraduate and graduate work in Engineering from MIT - The Massachusetts Institute of Technology, in Cambridge, Massachusetts. The 80's found ENCO providing custom mission critical hardware and software applications to industrial manufacturing facilities. In 1992 ENCO introduced DAD486x, the pioneering graphical interface, hard drive and network-based audio storage and automation system. "DAD" received a Pick Hit award in 1993 from *Broadcast Engineering* magazine. Gene has made presentations at several international, national and regional broadcast conferences and is widely regarded as an expert in digital audio delivery systems for the broadcast industry.

Since 1992, Novacek and ENCO have been in the forefront of the growth of this industry segment. From promoting the use of non-proprietary hardware to being a co-author of the Cart Chunk standard for audio file transfer, to creating a programming language in an audio delivery product and redefining what it means to be responsive to customer needs; Gene has led, and in some cases pushed, this industry segment. Gene remains committed to open standards and communications between systems and utilizing customer requests to drive new development.

Gene continues to program and actively manage the day-to-day operations of ENCO Systems, Inc. in his hometown of Southfield, Michigan and the new ENCO Systems, Ltd. Operation near London, England. He has assembled and maintains a team with the same core values of excellence, responsiveness and attention to customer needs. Gene Novacek is an innovator, who has driven a large amount of the digital hard drive storage improvements and innovations over the past decade.

Awards, Honors and Distinctions:

In 1993 DAD received the Pick Hit Award from *Broadcast Engineering* magazine.

Robert Orban, Vice President and Chief Engineer

Orban/CRL
San Leandro, California

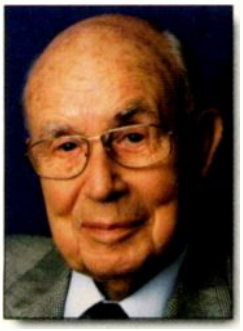
Accomplishments:

Robert Orban received the B.S.E.E. degree from Princeton University in 1967 and the M.S.E.E. degree from Stanford University in 1968. In 1970, he founded Orban Associates originally as a manufacturer of studio equipment. In 1975, Orban Associates introduced the original Optimod-FM 8000, which was the first in a long line of innovative broadcast audio processors from the company. In addition to Optimod 8100, 8100XT, 9000, and 9100, Orban also designed most of the studio products from the company, including a stereo enhancer and various spring reverbs, de-essers, and parametric equalizers. In 1989, Orban Associates, Inc. was acquired by AKG Acoustics, which, in turn, acquired the assets of dbx Professional Products in 1991. After this acquisition, Orban was heavily involved in the design of the dbx Project 1 processors, including compressors, a mic processor, and a parametric equalizer. Several patents resulted from this work. Orban remains actively working for the successor company, Orban/CRL, as Vice President (Chief Engineer). Orban was actively involved in the NRSC committee efforts that led to the NRSC-1 and NRSC-2 standards for AM, and has continued his membership in the NRSC to the present day. He has published refereed papers and engineering reports in the Journal of the Audio Engineering Society, Journal of SMPTE, and Transportation Society of Automotive Engineers. He has also been published extensively in *Radio World*, *BM/E*, and other trade press publications. He is the author of the chapter on "Transmission Audio Processing" in the *NAB Engineering Handbook*, 8th edition. He currently holds 25 U.S. patents.

Awards, Honors and Distinctions:

In 1973, he was elected a Fellow of the Audio Engineering Society. In 1993 he shared with Dolby Laboratories a Scientific and Engineering Award from the Academy of Motion Picture Arts and Sciences. In 1995, he received the NAB Radio Engineering Achievement Award.

Prof. Dr. Fritz Sennheiser, Founder



Sennheiser Electronic GmbH & Co. KG
Wedemark, Germany

Accomplishments

As founder of Sennheiser Electronic GmbH, Prof. Dr. Fritz Sennheiser brought many of the audio industry's watershed products to market, including the radio standard MD 2 and MD 21 microphones; the world's first shotgun microphone (MD 82); the MD 421 studio microphone with sales of over 400,000 units; the Mikroport wireless microphone system (in 1958); the world's first open-air headphones (HD 414); introduction of infrared transmission technology; Miniaturization of the SK 2012 transmitter and EM 1036 receiver, HiDyn RF noise-reduction technology; Assistive Listing devices; development of the NoiseGard and Digital Infra-red headphones, the evolution microphone assembly line and launch of the highly successful evolution wireless systems; and DVD-quality microphone technology (MKH 800: 20Hz - 50,000kHz). He founded the company in 1945 with a team of seven engineers and built the company up to its present stature of more than 1,400 employees and sales of nearly $200 million worldwide. Today, Sennheiser has four factories, one each in Wedemark and Burgdorf, Germany, one in Tullamore, Ireland, and one in the U.S. in Albuquerque, NM, as well as 10 sales subsidiaries and around 70 sales partners in all continents. Still active in the day-to-day operations of the company, Prof. Dr. Sennheiser recently celebrated his 90th birthday and was presented with the AES Gold Medal at AES Europe 2002.

Awards, Honors, Distinctions

In 1987, Prof. Dr. Sennheiser was awarded a Technical Oscar for the MKH 816 shotgun microphone. Nine years later, the U.S. television industry presented him with an Emmy Award for pioneering achievements in the field of wireless transmission technology. For nearly 20 years, he served in various capacities for the Association for Audio and Video Technology, ZVEI. In 1981 he was awarded the Karmarsch Commemorative Medal by Hanover University.

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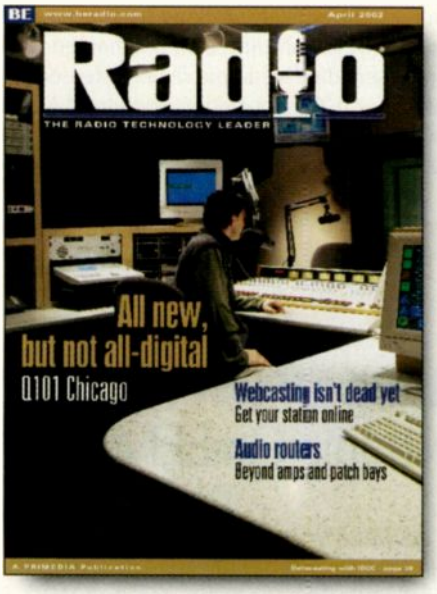

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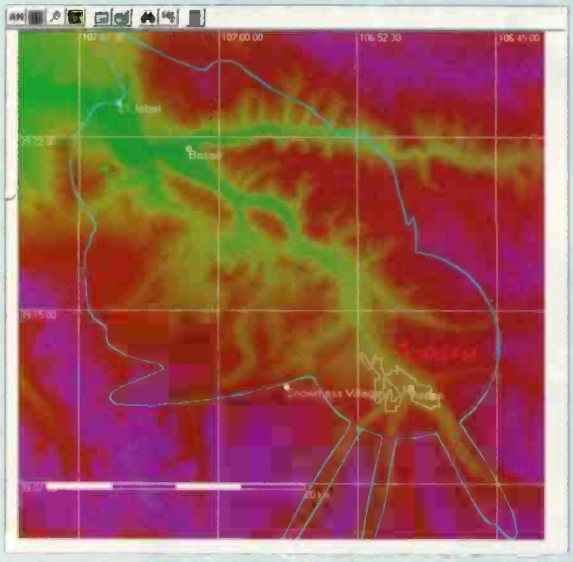

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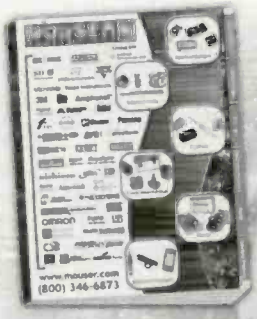

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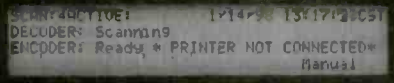

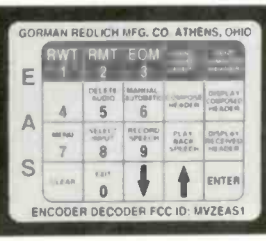

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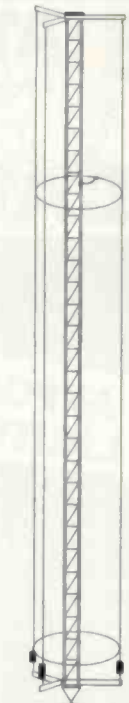

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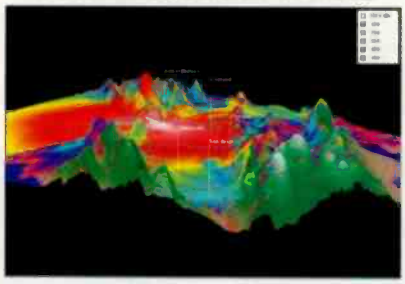

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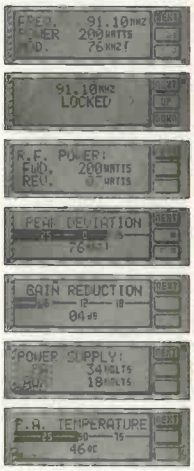

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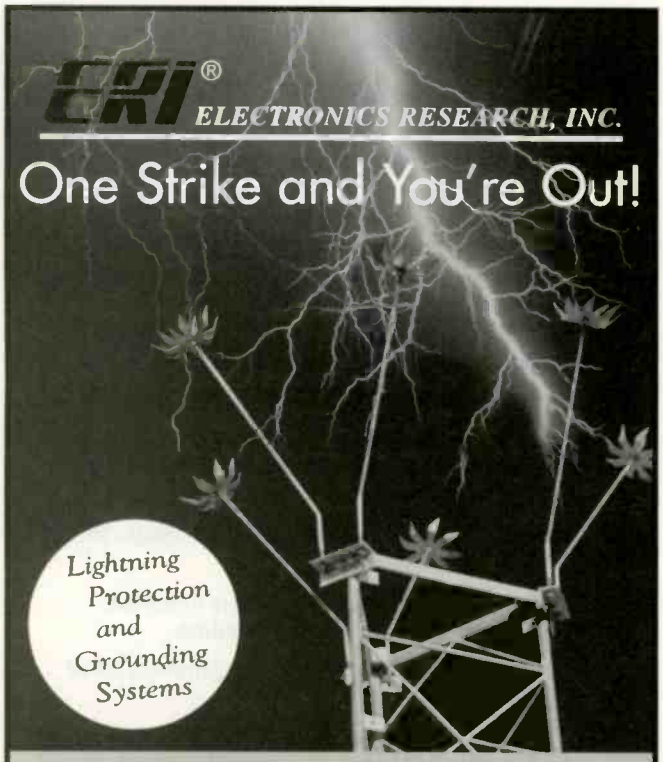

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Meet the professionals who write for BE Radio. This month: Talk Radio, page 30.

Tom Atkins
Director of Engineering
Entercom
Buffalo, NY

Tom Atkins has been in broadcasting for more than 28 years and has worked for Capital Cities, Taft, Keymarket, Sinclair and many others. He started as a disc jockey on a class IV AM station while attending college for engineering science. His experience includes on-air and programming. He gained his talk radio experience in the 70s and 80s while working for full-service AM stations. Two years ago, he completed the technical consolidation of six radio stations to one facility.

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Shaping radio today and tomorrow

By Kari Taylor, associate editor

Do you remember?

Originally designed in 1975 and 1976, Pacific Recorders and Engineering touted the benefits of separating the functions of processing and limiting an audio signal: The Multimax AGC/processor boasted three-band processing with energy-based,

open-loop compressors for the active gain control circuitry. A gated release circuit was used to smooth band tracking and gain control. Separate versions were sold for AM or FM use. These were mono units, so two were needed for stereo. Many TV stations installed FM units as well.

The Multilimiter featured a gain-riding compressor, a variable compression ratio fast limiter and an ultra-fast peak control limiter to provide peak control without a clipper.

Manufactured from 1976 to 1981, PR&E records show that there were more than 1,650 FM Multimaxes, 1,400 FM Multilimiters, 760 AM Multimaxes and 700 AM Multilimiters sold.

That was then

Drake-Chenault, one of the early automated programming providers, supplied more than 1,000 automation tapes each week to 300 stations through the 60s, 70s and 80s. A typical automated radio station could air tapes that were one week to one year old. It was important that all aspects of the production and duplication process were consistent. The production of music programming tapes for automated radio stations at Drake-Chenault evolved into a highly regimented process that produced a polished,

The Drake-Chenault tape duplicating system installed in 1978.

consistent product week after week.

The first duplication system was built in 1975 with nine Crown SX-722 decks. One master playback deck fed all nine machines. Stereo or mono copies could be made.

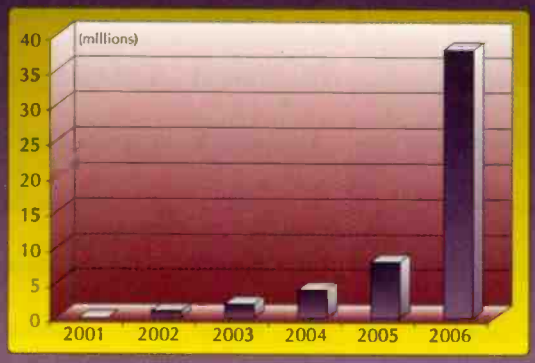
In 1978, the Crown decks were replaced with 24 Technics RS1500-US decks (shown here), which had much better transports than the Crowns. The isolated loop tape path was highly stable with less than 20 degrees of phase shift at 15kHz. This system had two master playback decks. Any of the 24 slave recorders could produce a stereo or mono copy from either master playback deck. A master start button would initiate the command for all 24 decks to start at once, an event that would make the floor shake. The 25Hz automation cue tones were generated and injected into the copies during duplication.

Info from Hank Landsberg. More info is available at www.drakechenault.org.

Sample and Hold

A look at the technology shaping radio

US Digital Radio Receiver Shipments Forecast



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Units can be stacked to suit particular card complements (analog or digital input and output cards or optical network cards) but more significantly cages can be separated by great distances and network their audio through either bidirectional fiberoptic links or a single CAT-5 wire. ONE INTERCONNECT DOES IT ALL: 64 channels of simultaneous bidirectional digital audio, intercage communication, X-Y controller commands plus auxiliary RS-232 data streams. This single interconnect between your studio and central rackroom can save you tens if not hundreds of thousands of feet of wire in a typical installation.

The 2001's graphic based setup software is intuitive and easy to use, with all the authorization and security levels you could want. And of course we have a full complement of control panels and PC applications to choose from—all designed for straightforward operation and a rapid learning curve.

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MIXED SIGNAL SWITCHING is easily accomplished with a choice of AES digital or ANALOG 24-bit A>D input cards, and of course 24-bit digital or 24-bit D>A ANALOG output cards, all of which can be serviced from the front of the cage. All signals are routed entirely in the digital domain.

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